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Improved Pipe-cutting and Threading Machines.

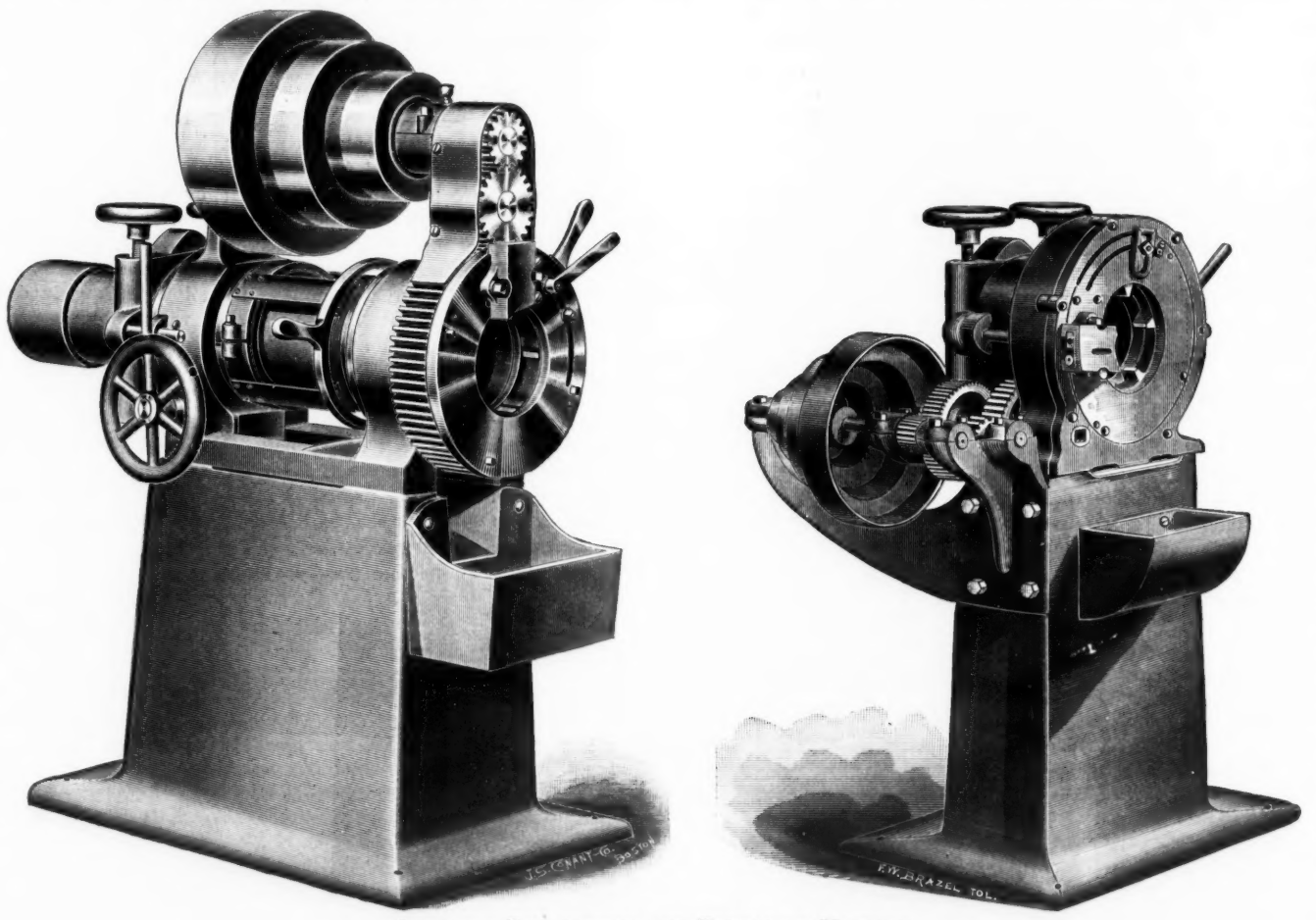
With this we present illustrations of some improved pipe cutting and threading machinery built by the Wells Machine Works, Fostoria, Ohio.

The larger of these machines is intended especially for machine shop service, and, while it requires but little space, has a wide range and is adapted for rapid changes from one size of pipe to another. It is so arranged that various sizes of pipe may be chucked, cut off and threaded without stopping the machine.

The chasers are actuated by a convenient cam movement, finely graduated, with positive adjustable stop. They are readily exchanged for chasers of any size, make, or pitch of thread, either right or left.

The cutting-off tool is always in position, is gauged to prevent over-feeding or plunging through uneven pipe, and is fed to its work automatically by retaining the lever to prevent it from rotating.

The machine is driven by a cone pulley (for 4′ belt) containing compound back gears completely housed from dust or accident, entirely out of the way, and giving six changes of speed; they are central over the base of the machine, thus equalizing the weight and securing symmetry and neatness. The proportion of the gears is such as to give a maximum of 100 feet belt travel to one revolution of the die head.



IMPROVED PIPE-CUTTING AND THREADING MACHINE.

The vise is nicely adjusted and self centering. It feeds the pipe into the chasers by rack and pinion movement with hand-wheel and lever. Or it may be fed by a lead screw which is engaged or disengaged by the movement of a lever.

This machine is made in two sizes, the larger one weighing 1,600 pounds, and being adapted for pipe from 1″ to 6″ diameter; the smaller weighing 100 pounds, and adapted for pipe from 1″ to 4″.

The smaller machine has the same general characteristics, but is differently geared, and is intended to be used either as a hand or power machine, being especially adapted for the use of contractors and erecters of steam plants. When in use, the gears shown in the cut are completely covered up, and when the machine is to be driven by hand they are disconnected. The machine can also be removed from its base for this purpose.

The adjustment of the die and the operation of the cutting-off tool are the same in this machine as in the larger one. This machine weighs 900 pounds, and is adapted for pipe from 1″ to 6″ diameter. The engravings show that the machines are of neat and symmetrical design, and the workmanship is equally good.

A Review of Fly-wheel Formulæ—II.

BY PROFESSOR JOSEPH TORREY.

The formula considered in the last paper depended only on the power of the engine, the speed and the size of the wheel. Those to be considered next represent one step in advance, in that they take some account of the actual distribution of energy throughout the stroke. As has been often shown and demonstrated before, the plain indicator diagram of steam action does not show *at all* the force that actually operates at the crank pin, much less that that is acting rotatively. In very slow engines the steam diagram may approximate to the diagram of effort on the crank-pin, but the diagram of "rotative effect" will always be quite different. In high speed engines these differences are much more marked. Now the force exerted rotatively is what keeps the wheel in motion; as this rotative effect falls off the wheel speed will tend to drop, and at the point where it is greatest the wheel speed will reach its maximum. One of the offices of the fly-wheel rim, made sufficiently heavy for the purpose, is to counteract the disturbing effect of the irregular rotative effect, and the weight of fly-wheel needed will obviously be fixed partially by and vary with the irregularity to be corrected.

Further—It is possible, knowing the conditions, to determine how much weight in the fly-wheel will be needed to reduce the irregularity existing to a certain fraction of itself. That is, if we have before us a diagram, or anything else which can give us a correct idea of the distribution of energy, we can easily see from it just what relation the excess of rotative effect at any point bears to the average rotative effect. Such a diagram, not representing any particular case, however, is shown in Fig. 1 (page 2). If rotative effect be considered as measured vertically, the line $M\,N$ representing the length of stroke, then the average rotative effect will be shown by the distance $N\,y$, and the line $x\,y$ is the line of average rotative effect. But the rotative effect from a to d is above the average by an amount represented at any point in the curved line by its distance above the average line $x\,y$. From c to b, on the other hand, the rotative effect is considerably below the average, and this is measured in the same way, but work is represented by the product of force into the distance through which it acts, therefore the average height of the small figure $c\,f\,d$ in pounds by scale, multiplied by its length in feet on the scale chosen, gives the work done above the average during one stroke. On the other hand, it is evident that the height $N\,y$ in pounds, multiplied by the distance $N\,e$ in feet according to scale will give the rotative work done per stroke. Now, knowing the relation between this excess of work and the average work, we can see that the speed will be varied correspondingly, unless there is some way found to counteract the tendency; but by suitable calculation it is possible to so proportion a fly-wheel rim, as to weight, that the fluctuations in speed arising from irregular effort will, by the inertia of the moving mass, be reduced to any fraction of their former value we may desire. The determination of the correct weight needed, or rather the production of a formula for doing so, becomes thus a mathematical problem, and not distinctively a mechanical one. The design of a fly-wheel according to this method, as it has been partially outlined in what has gone before in this paper, will not be as quick and easy a matter as by the older formulæ, but our wheel will be right when it is done, and will be heavy enough, without being too heavy.

The rules depending on these principles may be divided into two classes. In those belonging to the first class, the constant is introduced into the formula which is determined by the point of cut-off; moreover, since the object of the calculation is to find the weight of a wheel which reduces the irregularity of motion to a certain fraction of itself, the formula contains the denominator of that fraction. For instance, if we decide to reduce the irregularity of motion to $\frac{1}{60}$ of its value, then this number, 60, must appear in the formula for the fly-wheel by which this is to be accomplished. To-day almost all fly-wheel formulæ contain some inkling of this idea, but if we examine the history of the matter we shall find that the ideas as to the proper value of this fraction in different cases have varied widely, as will be seen from the following brief history, which, while not perfectly complete, is representative at least, and is all that is accessible to me now. We will, for the sake of brevity, call the denominator of the before mentioned fraction m.

From Watt's rule, given in the first paper, it can be calculated that m = about 36. Watt characterizes this as "delicate enough for most purposes." That is, the speed was found to be regular enough if the natural irregularity was reduced to $\frac{1}{36}$ its value.

From the Boulton Watt rule we should find m = about 45.

Bourne gives, as has been mentioned, a rule similar to Watt's old one, but aiming at the highest degree of steadiness that would be required, and from it we calculate $m = 60$.

Morin gives "for great regularity" m = from 37 to 45, and he adds that this conforms to the best practice; for cases where variations make little difference m can = 20.

Rankine, whose treatment of the subject of fly-wheels is the basis of about everything

that has been written since on the subject, who approached the subject in a remarkably simple manner, gives directly the following values: For ordinary machinery, $m = 32$. In machinery "for fine purposes," $m =$ from 50 to 60.

Hütte gives the following values (Des Ingenieur's Taschenbuch, p. 378):

For motion which may be very uneven, $m = 5$.

For pumps and heavy machinery, where some unsteadiness of motion is permissible, $m = 20$ or 30.

For work where the motion must approach uniformity, as in flour-mills for instance, $m = 25$ to 35.

For tolerably uniform speed, $m = 30$ to 40.

For machines requiring very uniform speed, as in cotton spinning, $m = 40$ to 60.

For machines for spinning high yarn numbers, $m = 100$.

John W. Nystrom gives for m values ranging from $\frac{1}{10}$ to $\frac{1}{100}$, as quoted by Professor Marks in his "Relative Proportions of the Steam Engine." Nystrom's analysis of fly-wheel, as given in his "Elements of Mechanics," has no explicit statement, and the rest of his work is not accessible to me.

Cotterill, in the latest edition of his "Applied Mechanics" (1884), p. 231, gives m as = 20 to 50 according to the degree of delicacy required in the regulation.

I have not mentioned Moseley's values, as they are the same as those given by Morin and others.

From this it would seem that considerable difference of opinion prevails as to what is close regulation.

The latest authority quoted above was Cotterill (1884). At this time the most exacting work a steam engine can do—namely, the work of driving electric light dynamos—was in its infancy. There is no work where a slight variation in speed shows as plainly as here, and a value is required for m which will give considerably closer work than was contemplated by most of the engineers quoted above. We will reserve the discussion of the proper value to be given to m in this case till later, and pass to a second point.

The rotative work done during the stroke varies, and in order to provide a fly-wheel of suitable dimensions it is necessary to know the amount of this variation; that is, we want to know what fraction of the total rotative energy per revolution can be taken as representing the sum of the two areas a and k in Fig. 1. Literature on this point, as well as on the value of m, is by no means concordant or satisfactory.

One of the very earliest to make any definite statements was Morin. As the result of his investigations, he gives the following table, which is here quoted from Rankine's "The Steam Engine," p. 60. Calling the fraction of the total energy which represents the excess of energy for one revolution c, we have:

FOR NON-EXPANSIVE ENGINES.

Length of connecting rod in cranks.....	8	6	5	4
Value of c..... ...	0.105	0.118	0.125	0.132

FOR EXPANSIVE CONDENSING ENGINES.

Steam cut off at	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{8}$
Value of c	0.163	0.173	0.178	0.184	0.189	0 191

FOR EXPANSIVE NON-CONDENSING ENGINES.

Steam cut off at.	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$
Value of c.....	0 160	0.186	0 209	0 232

Professor Marks gives a much more complete table, which considers engines expansive and non-expansive, condensing and non-condensing, with single crank, two and three cranks.

From this table I shall simply abstract what is necessary to make one that can be compared with Morin's table as given above:

FOR NON-EXPANSIVE ENGINES.

Length of connecting rod in cranks.	8	7	6	5	4
Value of c.....	0.2384	0.24 9	0.2487	0.2577	0.2717

FOR EXPANSIVE ENGINES.

Cut off at	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{8}$
Value of c	.3471	.4076	.4372	.4523	.4625	.4702

In the AMERICAN MACHINIST for May 29, 1880, Prof. S. W. Robinson gave an analysis of fly-wheel action. As the paper is not at hand I can only give what I can gather from a partial abstract of it by Mr. William JOHNSON, in the AMERICAN MACHINIST for May 13, 1882. Professor Robinson evidently dealt with the question from a mathematical point of view and took as the basis of calculation the rotative effect of the steam force. He gives as the value of c, which he calls the "value for cut-off," from 0.16 to 0.22.

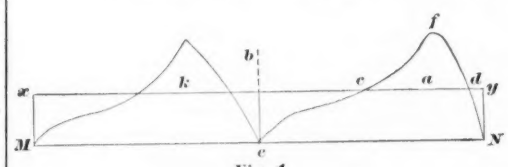


Fig. 1

FLY-WHEEL FORMULÆ.

There has not been much original work on this point. Most writers have followed Morin's values. One thing is evident—there is no concordance in the values, even for similar conditions. It is also evident that the value of c, or, in other words, the distribution of rotative energy throughout the stroke does not depend solely on the length of connecting rod and the point of cut-off. It does roughly, but this is one of the points we need to know the most accurately in making our fly-wheel formula. It depends on whether the compression is constant or variable. It depends on the weight of reciprocating parts to a very marked degree. It is a sort of characteristic of each particular combination of these factors, and must be determined for each such combination. The process is an easy one, and one method of carrying it out was given by the writer in the AMERICAN MACHINIST for August 20, 1891. In the next paper I will consider the manner in which these factors m and c are used in developing fly-wheel formulæ, and give a number of examples of such formulæ. We will then examine them in their application to a practical case, and see whether the results are concordant. Some writers have, in their work, only partially carried out the principles stated in the first part of this paper. The difference between the two classes will probably show on applying them to actual cases.

Improved Gun Barrel Drilling Machine.

The advent of this machine, illustrated in the accompanying cut, will undoubtedly affect the manufacture of the smaller caliber rifle barrels to a greater extent than any other invention during the past fifty years. The operator can, without any particular effort of mechanical skill, drill a continuous hole through solid stock, and, if conditions are what they should be, there will be found little deviation from a straight central bore of uniform size.

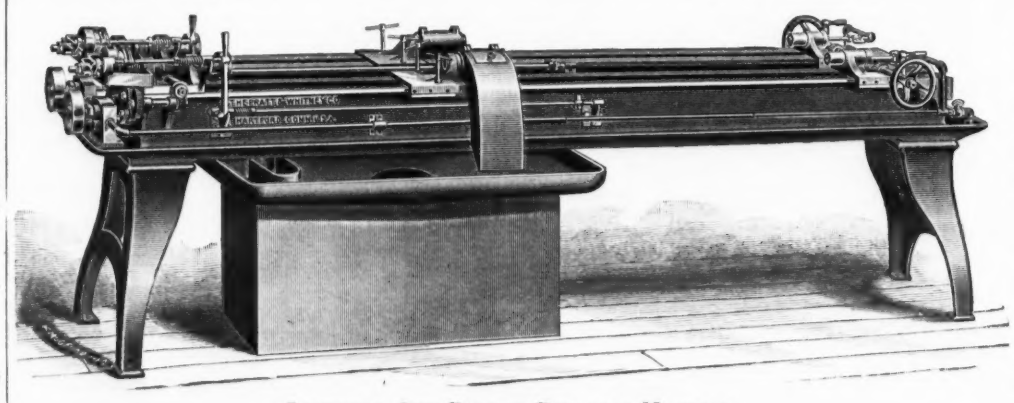
No particular apparatus is required for starting the drill, neither is any straightening required during the operation, and little or none until after the proof reaming.

The machine is double, and has a horizontal bed. The heads are at the end, and have mounted in them independent spindles parallel to each other. On their inner ends are chucks for securing and rotating the barrels in the adjustable rests which support, guide and control the starting of the drills, which are secured in the sliding carriages. These are fed positively 38″ by a screw having automatic stops. The screw has a variety of speeds through change gearing, in order to compensate for the different qualities of stock to be drilled.

Two rotary pumps (one for each barrel) force oil, supplied from a tank placed underneath the machine, through a series of tubes into and through the drill. The oil lubricates the cutting lip, and forces out the chips into the basin on the top of the tank, where they are drained, and the strained oil returned to be pumped again.

The countershafts drive both machine and pump, and can be especially arranged (for jobbing purposes) to cover the required speeds for drilling bores from 0.2″ to 0.75″. Rifle barrels 30″ long, 0.3″ bore can be drilled (with each spindle) in 1¼ hours; the same length 0.75″ bore in 1½ hours.

The machine is manufactured by the Pratt & Whitney Co., Hartford, Conn.



IMPROVED GUN BARREL DRILLING MACHINE.

Aluminum and its Uses.

[ALFRED E. HUNT, in *Minerals*.]

Aluminum is now being made throughout the world upon a commercial scale only by processes of electro-deposition from fused electrolytes. In this country the Pittsburgh Reduction Company and the Cowles Electric Smelting and Aluminum Company are the only concerns manufacturing commercially and furnishing the American market with aluminum. In Great Britain the Metal Reduction Syndicate, Limited, a branch of the Pittsburgh Reduction Company, and in Switzerland the Aluminum Industrie Actien Gesellschaft, manufacturing at Neuhausen, using the water power of the falls of the Rhine, and in France the firm of Bernard Brothers, now building works at St. Michaels, and operating the Minet process, are, so far as the writer's knowledge goes, the only manufacturers now whose metal is met in the competition of the world's rapidly-growing market for aluminum. These statements need to be made preliminary to any considerations of the purity or other qualities of the commercial aluminum of the markets of the present day, for the reason that manifestly it will not be fair to take into consideration, in treating of the commercial aluminum of to-day, the impure products made only on a small scale by the great number of processes being experimented upon.

Both the Neuhausen concern and the Cowles, as well as the Metal Reduction Syndicate, Limited, of Patricroft, Lancashire, England, and the Pittsburgh Reduction Company, find no trouble by the electrolytic process in producing regularly, metal with less than one per cent. of impurity. Indeed, the best results in quantity, output, and regularity of working, and therefore in economy of manufacture, are when producing the purest aluminum, and it only requires further development of the manufacture of the aluminum oxide used as the ore and of the carbon anodes—matters which are perfectly practicable and possible—to obtain almost absolutely chemically pure aluminum by the electrolytic methods now in use.

I have already, in a previous lecture, in February, 1891, before the Boston Society of Arts, stated that the cost of manufacture under the most favorable conditions with water-power and large output, would be approximately 20 cents per pound. Nearly one year's experience and careful study of the matter leads me to reiterate the statement then made, and to prophesy that the ingot metal will be made by the Hall process within the next few years at a cost of between 18 and 20 cents per pound, the items of cost being about one-third for the ore, one sixth for the expenditure of other materials than ore, one-third for the electrical current expended, one-twelfth for labor and superintendence, and one-twelfth for general expenses, interest and repairs.

Aluminum will not be manufactured by any process at much less than at present, nor will it be sold at much lower rates, until the output be measured in tons, and not pounds, per day. The lowering of the market price of aluminum in the future will be gradual, and will be directly proportionate to the decrease in cost of manufacture, due to increased capacity of the manufactories.

The properties of aluminum which will probably give it the greatest availability in the arts are:

1. Its relative lightness.
2. Its non-tarnishing quality as compared with many other metals—aluminum not being acted upon by sulphur fumes at all, and being very much more slowly oxidized by moist atmosphere than most of the metals.
3. Its extreme malleability.
4. Its easy casting qualities.
5. The influence of the metal in various alloys will give it advantages, some of which I will try to enumerate and call to your attention.
6. Its high tensile strength and elasticity when weight for weight of the metal is compared with other metals, and especially when alloyed with a small percentage of titanium, silver, or copper, and properly worked by being rolled or hammered or otherwise drawn down.
7. Its high specific heat and electrical and heat conductivity.

Unfortunately, aluminum is not, section for section, as has been widely claimed, comparatively a very strong metal. It is only about as strong under tensile strain, section for section, as cast-iron, and has less than one-half the strength of wrought-iron under ordinary conditions. Under compression, the metal, unfortunately, has a very low elastic limit, although its extreme ductility allows the metal to flow on itself so freely as to make it, for special purposes, a very safe metal to use in compression.

The same remark applies to transverse test of aluminum. It is not a rigid metal at all, and bends under transverse strains very readily.

Under torsional stress the metal has much lower modulus of rigidity than iron or steel; its maximum shearing stress in castings is about 12,000, and in forgings about 16,000, being about that of pure copper. The angle of torsion is about equal to that of the softest steel.

The tensile strength of aluminum wire runs up very considerably over that of rolled metal. This is due to the peculiar property of aluminum to harden under work. The metal requires frequent annealing in rolling, and if it is to be drawn into wire, with as little annealing as possible, the tensile strength is increased very considerably. This property of the metal is increased, especially if the aluminum is alloyed with a small percentage of copper, titanium, or silver.

Two things, however, should always be borne in mind in considering the applicability of aluminum for given purposes in the arts. The first is that the properties of the metal are very considerably changed as regards strength, tenacity, hardness, rigidity, and color, by alloying it with small percentages of other metals, conditions that do not materially change the specific gravity of the metal. The second is the relative weight of aluminum. Taking the tensile strength of aluminum in relation to its weight, it is, in plates, as strong as steel at 80,000 pounds per square inch ultimate strength, and in cold-drawn wire as strong as steel at 180,000 pounds.

The specific gravity of aluminum is one of its most striking properties. It varies from 2.56 in ingots to 2.70 in forged bars. The weight of a given bulk of this metal compares with others as follows:

Aluminum	1.00	Nickel	3.50
Wrought-iron	2.90	Silver	4.00
Structural steel	2.95	Lead	4.80
Copper	3.60	Gold	7.70
Ordinary high brass	3.45	Platinum	8.60

A cubic inch of cast aluminum weighs 0.092 pounds; of rolled sheet metal, 0.098 pounds.

Wherever momentum is to be overcome, as in the reciprocating parts of many forms of machinery, aluminum can be advantageously used.

Aluminum does not oxidize so as to interfere at all with the strength of thin sections of the metal, as do iron and steel; the thin film of oxide which covers surfaces of the metal which have long been exposed to moist atmosphere seems to prevent its being further acted upon. But it does give a surface tarnish to the metal, which cannot be rubbed off with the usual metal-polishing compounds without interfering with the surface of the soft metal. This, however, can be removed by rubbing with a flannel rag which has been immersed in a 2 per cent. solution of hydrofluoric acid, and then again rubbing up the polish with a rag saturated with carbon oil. Special aluminum polishes have been devised which work very efficiently. When properly cared for, polished surfaces can thus be kept bright for a remarkably long time.

As compared with most metals, pure aluminum, under ordinary circumstances, withstands the action of wind and weather exceedingly well; and many uses to which the metal is now being successfully applied are based upon this fact. The presence of silicon in aluminum materially detracts from its power to withstand corrosion due to atmospheric influences. Metal with 4 per cent. or 5 per cent. of silicon very soon collects a thick coating of oxide upon it, if severely exposed. The fact that pure aluminum is not severely acted upon by boiling water or by steam has led to its successful use as a packing or gasket in steam connections, where lead and similar metals have been rapidly cut out, as in parts of steam and water pumps and difficult steam joints.

For structural purposes under water, where metals are required, aluminum seems to be especially adapted to replace the more easily corroded cast and wrought-iron and steel now in general use for such purposes. For liners and shims upon masonry foundations aluminum is well adapted, as it flows sufficiently to allow equal bearings on all parts; it is less easily cut out than lead, and much more durable than tinned iron sheets, which are now in general use under heavy structures of metal resting on metal shims on masonry.

Aluminum sheets will make a much more durable and satisfactory roofing than sheet copper, now generally used in valuable buildings.

Pure aluminum is very sonorous, and its tone seems to be improved by alloying with a small percentage of silver or titanium. For the sounding boards of musical instruments aluminum has been proved to be well adapted.

Pure aluminum, when properly treated, is a very malleable and ductile metal. It can readily be rolled into sheets 0.0005 inch thick or be beaten into leaf nearly as thin as gold leaf, or be drawn into the finest wire. Pure aluminum stands third in the order of malleability, being exceeded only by gold and silver, and in the order of ductility seventh, being exceeded by gold, silver, platinum, iron, soft steel, and copper. Both malleability and ductility are greatly impaired by the presence of the two common impurities—silicon and iron.

Aluminum can be rolled or hammered cold, but the metal is most malleable at, and should be heated to, between 350° and 400° Fahrenheit for rolling or breaking down from the ingot to the best advantage. Like silver and gold, aluminum has to be frequently annealed, as it hardens up remarkably upon working. Due to this phenomenon of hardening during rolling, forging, stamping or drawing, the metal may be turned out very rigid in finished shape, so that it will answer excellently well for purposes where the annealed metal would be entirely too soft or too weak, or lacking in rigidity, to answer. Especially is this true of aluminum alloyed with a small percentage of titanium, copper or silicon. It can be safely stated, as a general rule, that under similar conditions the purer the aluminum the softer and less rigid it is.

Aluminum can be annealed by heating and allowing to cool gradually; the best temperature is just below the red heat. Thin sections can be annealed by heating in boiling water.

Aluminum can be easily and readily welded by electrical apparatus, and a cheap and satisfactory solder has been discovered.

Sound castings of this metal can be made in dry sand molds or metal chills. It requires, however, some experience to master its peculiarities before sound castings can be uniformly made. The aluminum should not be heated very much beyond the melting point; if too hot it seems to absorb gases which remain in the metal, preventing sound castings. In small quantities the metal can be best melted in plumbago crucibles; but in large quantities it can be more economically melted in a reverberatory furnace with alumina or magnesia brick sides and alumina bottom. The furnace should have a tap-hole for drawing off the liquid metal into carbon lined ladles. In no case need the metal be covered with a flux to assist in the fusion or to form a covering of slag. In fact, owing to the metal's lightness, the presence of any flux will tend to unsoundness, due to particles of it becoming entangled in the castings, while impurities may perhaps be added to the metal by the action of the flux on the lining of the melting vessel. The shrinkage of 17-64 inch per foot, which aluminum has, is considerably more than that of brass, which is about 3 32 inch per foot.

Undoubtedly, one of the greatest uses for aluminum in the arts will be in the form of alloys with other metals. Aluminum in proportions of a small percentage added to very many different metals gives valuable properties. Among these alloys is, of course, aluminum bronze. The alloys of from 2½ per cent. to 12 per cent. aluminum with copper have so far achieved the greatest reputation. With the use of 8 per cent. to 12 per cent. aluminum in copper, we obtain one of the most dense, finest-grained, and strongest metals known, having remarkable ductility as compared with its tensile strength. A 10 per cent. aluminum bronze can be made in forged bars with 100,000 pounds tensile strength, 60,000 pounds elastic limit, and with at least 10 per cent. elongation in eight inches. An aluminum bronze can be made to fill a specification of even 130,000 pounds tensile strength and 5 per cent. elongation in eight inches. Such bronzes have a specific gravity of about 7.50 and are of a light yellow color. For cylinders to withstand high pressures, such bronze is probably the best metal yet known.

A small percentage of aluminum added to Babbitt metal gives very superior results, increasing the durability and wearing properties of the alloy. It is a little softer than the ordinary Babbitt, but in comparative tests has given very satisfactory results. One advantage of this alloy is its extreme malleability. It can be hammered out to a thin edge without cracking. An advantage of this is that for bearings the aluminum Babbitt can be rolled into shape for inserting in the dovetailed recesses, which can be cut and drifted out at a very small expense, and the amount of Babbitt required is reduced to a minimum.

Aluminum is also being used very successfully in steel castings, and has added very considerably to the progress which has been made within the last two years in obtaining sound steel castings. A large number of steel casting companies are regularly using the metal aluminum in quantities of from one-half pound to several pounds of aluminum to the ton of steel. In the manufacture of ordinary steel ingots by the open-hearth and Bessemer processes, it has lately been shown in the article on "Aluminum in Steel Ingots," by Prof. J. W. Langley, at the January, 1891, meeting of the American Institute of Mining Engineers, that the use of aluminum in small proportions (from one-third to three-fourths of a pound of aluminum to the ton of steel) has proved to be an economical success, preventing blow holes and unsound tops of ingots.

Alloys of aluminum with copper in proportion of from 2 per cent. to 15 per cent. have been advantageously used to harden aluminum in cases where a more rigid metal is required than pure aluminum. Copper is one of the most common metals used at present to harden aluminum. A small per centage of copper decreases the shrinkage of the metal and gives alloys that are especially adapted for art castings. The remainder of the range, from 15 per cent. copper up to over 85 per cent., give crystalline and brittle alloys of no use in the arts; which are of a grayish white color, up to 80 per cent. copper, where the distinctly yellow color of the copper begins to show itself.

With the exception of lead, antimony and mercury, aluminum unites readily with all metals, and many useful alloys of aluminum with other metals have been discovered within the last few years, and I prophesy that many more will be found within the next few years. I consider this field as one of the most promising for investigation, of any of the "aluminum problems." The useful alloys of aluminum so far discovered are all in two groups—the one of aluminum with not over 15 per cent. of other metals, the other of metals containing not over 15 per cent. of aluminum; in the one case the other metals imparting hardness and other useful qualities to the aluminum, and in the other the aluminum giving useful qualities to the other metals.

Titanium and chromium can be readily alloyed with aluminum according to methods devised and patented by Prof. John W. Langley. This will probably prove to be the most valuable means of hardening aluminum; a small percentage of titanium rendering the metal, under work, very rigid and yet elastic at the same time. Chromium is the best metal for hardening aluminum castings; the triple alloy being best adapted where a very hard and yet elastic material is required.

More or less useful alloys have been made of aluminum with bismuth, nickel, cadmium, magnesium, manganese and tin, these alloys all being harder than pure aluminum; but it is by combination of these metals, with additions, perhaps, of copper, lead and antimony, that alloys of most value have so far been discovered. Some are additions of only 1 per cent. to 2 per cent. of aluminum.

The modifications of pewter, britannia, white metal, delta metal, and the like, with additions of aluminum, have shown very useful qualities, and will add considerably to the demand for aluminum in the near future.

The following alloys have recently been found useful: Nickel-aluminum, composed of 20 parts nickel and 8 parts aluminum, used for decorative purposes; rosine, composed of 40 parts nickel, 10 parts silver, 30 parts aluminum, and 20 parts tin, for jeweler's work; sun bronze, composed of 60 parts cobalt, 10 parts aluminum, 40 parts copper; metaline, 35 parts cobalt, 25 parts aluminum, 10 parts iron, and 30 parts copper.

Prof. Emmens has great hopes for an alloy of aluminum bronze and nickel for a gun metal.

The addition of from 5 to 15 per cent. of aluminum to type metal composed of 25 per cent. antimony and 75 per cent. lead makes sharper castings and more durable type.

To ordinary brass the addition of aluminum gives superior strength and better anti-corrosive qualities.

Aluminum has been successfully used to replace lithographic stone.

Powdered aluminum mixed with chlorate of potash is used to give a photographic flash light, which gives much less smoke than the magnesium compounds used.

The Tacony Iron Metal Company, a well-known Philadelphia concern, has successfully produced an aluminum coating for iron, which undoubtedly will have considerable use in the future. To the inventors who shall produce good methods of nickel, silver and gold-plating aluminum, so that it can take the place of German and nickel silver, a rich reward is in waiting.

Strange Wonder Work of Nature in Wyoming.

One of nature's strangest freaks, one of the greatest wonders of the world, is the Devil's Tower, or, as the Sioux Indian calls it, the Mateo Tepee, or the Bear's Lodge, which stands on the banks of the Belle Fourche River, in a northeastern county of Wyoming. The country for 50 miles around consists of high table lands, deep canyons, and narrow, fertile valleys—nothing to indicate the possible existence of any such freak of nature.

The tower is a gigantic column, a monster obelisk of lava, which rises to a height of 1,727 feet—almost twice the height of the Eiffel tower. At the base the huge shaft measures 326 feet through in one direction. Huge crystals of the volcanic rock, measuring one to three feet through, start at the base and run unbroken to the top, giving to the column a peculiar fibrous appearance, even when viewed from the table lands, forty miles away.

How did it get there? How was it made? Once in a while, in the present age, we have heard how portions of the bottom of one of the oceans have been pushed up by volcanic forces, and even a new island added to the charts. Ages on ages ago similar volcanic forces started a jet of lava up from the bottom of the ancient geological ocean that covered all the northwest at that time. The squirt of molten rock evidently did not break through it into the waters above, but froze, as an iron man would say, in the hole it had made. This slow cooling off, the gradual loss of its fiery energy, probably lasted for many long years, and gave time for the particles to arrange themselves in the huge crystals that arouse all of our astonishment to day.—*Exchange.*

An Erie (Pa.) dispatch says:

The bravery of Engineer James Butler, of the Southwest Limited, on the Lake Shore and Michigan Southern Railroad, saved his train of sleeping passengers from a horrible fate at an early hour this morning. A freight train had run the block at Girard, and had plunged into the grape train, also west bound.

The collision occurred on the fill over Elk Creek, and the cars fell away over 100 feet on both sides. Between twenty and thirty cars were wrecked.

The Southwest Limited, running a mile a minute, soon hove in sight from the West.

Engineer Butler's eye caught sight of the wreck which covered his track, and with sand, air-brake, and reversing bar he stood at his post, and saved his train and passengers on the verge of the precipice, although he and his engine were buried in the débris. Butler and his fireman were taken out alive.

It is rather apparent that anything can be worked in New York if there is money enough behind it. For example, the trolley system of electric propulsion is finding favor in New York—in all places in the world in which that system should not prevail.

On the Cultivation of the Inventive Faculty by the Solution of Constructive Problems.

BY LEICESTER ALLEN.

Herewith are presented a number of interesting solutions of the problem published in the AMERICAN MACHINIST for July 28th, following those previously published.

Mr. Emil C. Schmalz, of Chicago, Ill., has forwarded one which is both ingenious and simple. It provides for a horizontal rotation of the hub, first in one direction and then in the opposite direction - a movement consistent with a strict interpretation of the problem as enunciated, and a movement which may prove useful in many applications Figs. 1, 2 and 3 illustrate this device.

The hub *a* is splined to the shaft *b* so that both rotate together, while the hub is free to slide vertically on the shaft, the hub being supported on the arm *c*, which has a fork at *d* (Figs. 1 and 2) fitted to a groove in the hub. The arm *d* is joined by a bend at *e* with the vertical bar *f*, which slides in a guide *g* that may be attached by brackets *h* to any suitable support. The bar *f* may be either rectangular in form, to prevent its turning on its vertical axis, or it may be a round bar splined in the guide *g*.

To the shaft *b* is keyed an arm *k*, carrying at its outer extremity a stud that fits into a cam groove formed in the perimeter of the cam wheel *l*; the development of this groove is shown at *m*, Fig. 3.

To the lower extremity of *f* is attached a roller *n* that runs in a cam groove *o*, formed in the flat side of the cam wheel *l*. These cam grooves are so related as to position, that, when the cam wheel is turned in the direction indicated by the arrow, the hub *a* is lifted into the position shown in Fig. 1, remaining in that position of elevation while the cam rotates through the arc *p q*, and so that the stud in the end of the arm *k* enters the part *t* of the groove *m*, Fig. 3, at the same time the point *v* of the groove *o* reaches the roller *n*. The angular distance from *t* to *s*, in degrees of arc, being the same as from *v* to *q*, the point *r* of the groove *m* will reach the stud in the arm *k*, and give the desired horizontal rotation in one direction, the point *s* reaching the stud in the arm *k* at the same time that the point *q* reaches the roller *n*. The hub *a* will then be lowered while the cam wheel rotates through the arc *q w*; and as the angular distance from *q* to *v* is the same as that from *v* to *q*, and the angular distance in degrees of arc from *p* to *q* is the same as that from *w* to *v*, all the movements of the hub will be reversed while the cam wheel moves through the second half revolution. This includes, therefore, a horizontal rotary movement of the hub, while in the lower position, not called for in the problem.

If, instead of keying the arm *k* to the shaft *a*, a ratchet and pawl connection were provided, the rotary movement of the hub could be confined to its upper position, and it could be made to rotate always in one direction. The reversal of the motion in the lower position may, however, be useful for some purposes. The solution is redundant, in giving a motion of rotation in the lower position of the hub, and as this was a position of rest, so defined in the enunciation of the problem, the solution cannot be fully approved.

Figs. 4 and 5 illustrate a device for effecting the movements required, contributed by Mr. Albert L. Colburn, of New Haven, Conn.

Fig. 4 is a plan view, and Fig. 5 a side elevation.

As described by Mr. Colburn, *a* is a wheel with six similarly formed notches formed in its perimeter, and *b* is a wheel with one tooth. (It will be seen that these two wheels constitute substantially the old and well-known "Geneva stop movement," so called from having probably originated in Geneva, Switzerland, and, so far as known, having its first application in watches, music boxes, etc. The advantage of this movement is that the hub, when turned by it, will be brought to a positive stop at the end of the rotation; and it has the further advantage that it is capable of being made with any requisite degree of strength. Mr. Colburn, as will be seen in a future article, is not alone in perceiving these advantages).

The hub is shown at *p*, Fig 5, splined to the shaft *s*, *h* being a collar sliding freely on the shaft *s*, and connecting the hub *p* with the wheel *a*.

The single-toothed wheel *b* is keyed to the shaft *s'* in such manner that its upper surface is in the same plane as the upper surface of the wheel *a*, when the hub is in its lower position—the position shown in Fig. 5; and when *a* is lifted, as described below, *h* and *p* are also lifted. On the under side of the notched wheel *a* are formed *cams*, *e e*, etc., being their inclined surfaces, and *o o*, etc., being flat underside surfaces of these cams. These cams co-act with the cam *c* to lift the parts *a h* and *p*, when the shaft *s'*, the segment *n* and cam *c* are rotated continuously in the direction indicated by the arrow marked on *c*, this action being more fully described by Mr. Colburn, as follows:

"The cam *c* is shown in Fig. 4 as about to come in contact with one of the inclined surfaces *e* of the cams under the wheel *a*. When the entering part or angle of *c* has traversed the length of the inclined surface *e*, the parts *a h* and *p* will rise no farther; but the flat top of *c* will slide around on the flat surface *o*, giving the desired period of rest in the upper position, after which the tooth in *b* enters the notch *g*, causing the wheel *a* to make one-sixth of a turn. After the tooth has passed out of the notch, the flat surface *o* will have traversed from k_2 to k_1, and the angle of *c*, which is shown at *k*, in Fig. 4, will pass out from under the flat supporting surface of the cam under the wheel *a*, and allow the parts *a*, *h* and *p* to drop into their lower position, where they will rest until the shaft *s'* has completed its revolution. At each revolution of *s'* the movements are repeated.

"The face of the wheel *a* is made wide enough vertically to permit the required vertical movement of the parts *a h p*, yet this wheel will remain locked by the face of the wheel *b* at all times when not engaged with the tooth.

"The hub, collar *h* and wheel *a* are all made in a single piece, as are also the toothed wheel *b*, collar *m*, and segment *n* carrying the cam *c*."

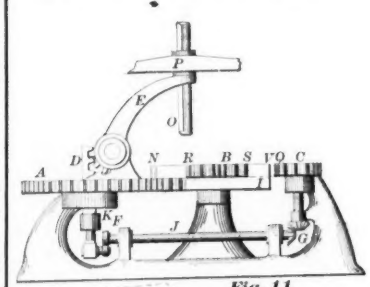


Fig. 11.

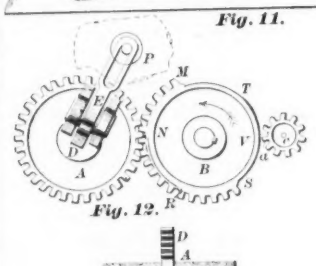


Fig. 12.

Fig. 13.

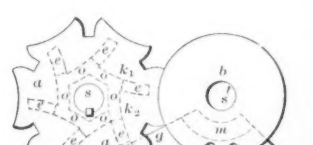


Fig. 4

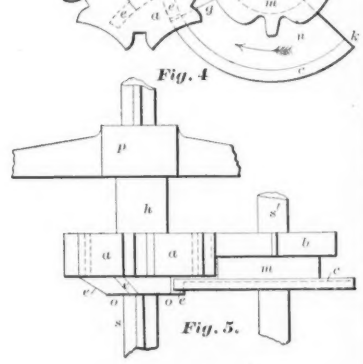


Fig. 5.

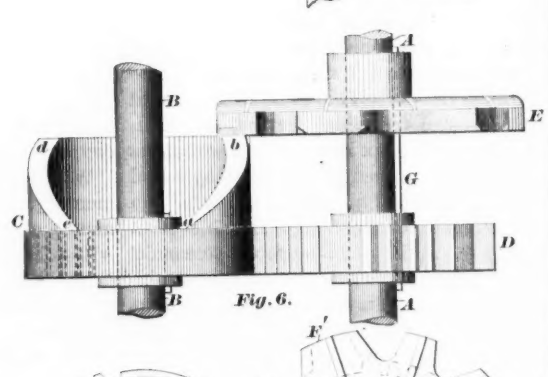


Fig. 6.

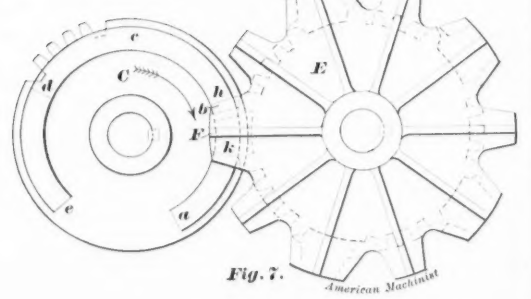


Fig. 7.
American Machinist

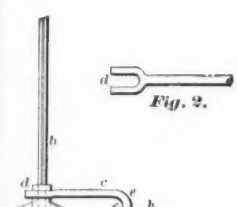


Fig. 2.

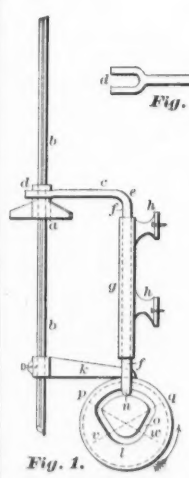


Fig. 1.

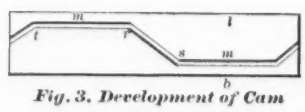


Fig. 3. Development of Cam

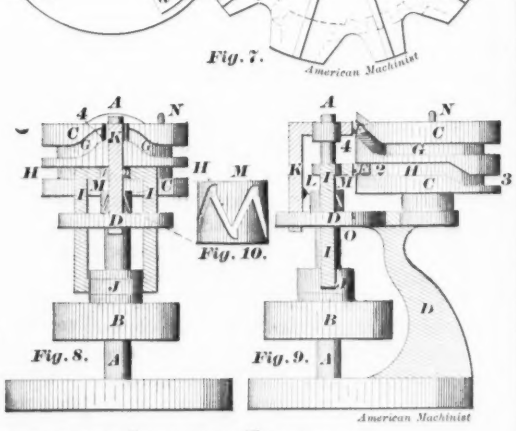


Fig. 8. Fig. 9. Fig. 10.

ON THE CULTIVATION OF THE INVENTIVE FACULTY.

Mr. Colburn writes that he has considered the best solution would be the one comprising the fewest necessary parts; and, beyond question, the acme of simplicity is reached in his device, which contains only the two shafts and the two parts *a h p*, and *b m n*. In point of simplicity, it is difficult to conceive how his solution can be excelled; moreover, it is in every way good mechanical construction, being easy and cheap to make, and durable in action.

An almost equally simple solution is supplied by Mr. C. E. Sargent, of Chicago, Ill., the device being shown in Figs. 6 and 7, and described by him as follows:

"*A A* in the elevation is the vertical rotating shaft; *E* is the hub splined to the shaft, so that both will rotate together; *C* is the driving wheel which is supposed to revolve with a uniform motion with the shaft *B B*; *D* is a toothed wheel keyed to the shaft *A A* by the same spline that passes through the hub.

"The first condition is that, from a state of rest of both the shaft and hub, the latter shall slide up the shaft *A A* a definite distance. Let the wheel *C* revolve in the direction of the arrow. After the end of the cam *e* passes the point *k* on the lug *F*, both the shaft and the hub will remain at rest until the end of the cam *a* strikes the point of the lug *F*. While the cam *a b* is passing *h*, the hub will slide up the shaft a definite distance. From *b* to *c* the hub will remain at rest, the lug *F* resting on the cam *b c d*—another condition of the problem. At the end of this stage of rest the segment on the wheel *C* engages with the segment on the wheel *D*, and revolves the shaft *A A* and the hub *E* one-fifth a circumference—another condition of the problem. As soon as the wheel *D* comes to rest the point *d* on the cam leaves the lug *F*, and the hub descends to its former position. I think that this solution of the problem is simple and correct, but whether it would be a good way to accomplish the work required will depend, probably, on other conditions of the problem not stated."

A solution in which both the lifting of the hub and its rotation are effected by cams, and which evinces a good conception of the possibilities of the cam in effecting irregular movements, has been wrought out by Mr. C. E. Hunt, of San Diego, Cal.

"Figs. 8, 9 and 10 illustrate this device, in which *A* is the shaft, turned smaller from *o* upwards, to prevent its lifting; *B* is the hub; *C* is a revolving cam driven by power applied to *N*; *D* is the stand or table; *E* and *F* are rollers working in their respective grooves *G* and *H*, *H* going around the circumference of *C* two-thirds of its distance at 2, Fig. 9, and one third at 3, so that *B* is at the top as long again as at the bottom. The hub *B* is raised and lowered by the rods *I*, which are moved by the roller *F* working in *H*.

"The shaft is rotated by a roller *E* working in *G*, the raised part of which, marked 4, in Fig. 9, is placed midway between the points of raising and lowering accomplished by the action of the roller *F*. As *E* is raised and lowered it carries with it the arm *K*, which has a pin *L* working in the endless V-cam *M*, Fig. 10, that is secured to the shaft *A*. There are five of these Vs in the circumference of the cam *M*, so that the shaft will make one-fifth of a revolution at each up and down stroke of *R*.

"*J* is a loose strap around *B*, and, being secured to *I*, it allows *B* to rotate with the shaft. Both *I* and *R* slide up and down the upper part of the shaft *A* as a bearing, but do not prevent it from rotating."

Mr. Hunt writes that this is his first attempt at solving a constructive mechanical problem; as such, it must be considered an exceedingly creditable effort.

In Figs. 11, 12 and 13 is illustrated another device worked out by Mr. Leo Rebay, of Jersey City Heights, N. J., which, for a youth of only 17 years, shows a good degree of both analytical and inventive faculty. The description furnished by him is also so clear that I quote it below without material amendment. Mr. Rebay modestly expresses the hope that he will not, on account of his age, be considered an intruder. His apology is entirely unnecessary, as he has contrived a very ingenious movement, and I am glad that young men take an interest in these problems. I think this young man, and also some other young men who have sent in solutions for this and former problems, are likely to intrude to some purpose into the mechanical world in due time.

"Fig. 11 is a side elevation, Fig. 12 a partial plan, and Fig. 13 a sectional detail of Mr. Rebay's device, which he describes as follows:

"*B* and *I* are two cog wheels, keyed together so as to revolve as one. *B*, which turns *C*, has teeth only from *M* to *N* and from *R* to *S*; hence *C* is at rest during the time occupied by the toothless parts *M S* and *N R* to revolve, while *I* is toothed only from *N* to *R*, or one-sixth of a circle; hence

A, being turned by *I*, revolves one-sixth of a circle, and remains at rest during the remainder of the revolution of *I B*.

"*E* is lifted and lowered by *D*, which again is lifted and lowered by the crank *F*.

"*F*, through the shaft *J* and the bevel wheels at *G*, receives its motion from *C*. *K*, Fig. 13, allows *D* to turn with *A* without compelling *L* to revolve with it. Force is applied to *I* or *B* by some mechanism not shown.

"Starting with *N* at *Q*, and turning *B I* in the direction indicated by the arrow in Fig. 12, the wheel *C* will make one-half of a revolution, causing *D* to go down, *E* to go up, and the hub *P* to slide up on the shaft *O*. (Bearings of this shaft are not shown.) During this time *V S* will have passed *A*, and *V S* being a toothless part, *A* will have remained at rest. Now *M T* passes by *C*, *S R* passes *A*, and a total rest ensues. It must be remembered that the teeth from *S* to *R*, seen in Fig. 12, belong to the wheel *B*—not to *I*, as may be seen in Fig. 11.

"The period of rest last described is followed by the passage of *T V* by *C*, and the passage of *R N* by *A*; *C* is thus left at rest while *A* is turned one-sixth of a circle, causing both hub and shaft to revolve with it.

"Now *N M* passes by *A*, and *V S* passes by *C*, ending again in total rest, which is followed by *S R* coming into contact with *C*, which makes another half revolution and brings *D* up, and *E*, with the hub sliding on the shaft down, *M T* leaving *A* at rest. A total rest follows this, produced by *R N* passing by *C*, and *T V* passing by *A*.

"Now one revolution of the wheels *B I* has been completed, and, by keeping these wheels working, the same movements will follow indefinitely."

All letters forwarded to me evince increased interest in these problems, and there are a number of other solutions of the one now in hand, which, for want of space, cannot be noticed in the present article, but will be soon.

Cogging Wheels—VII.

BY JOSEPH HORNER.

MARKING OUT AND WORKING.

The cogs having been all driven in and properly secured, they have to be turned, and pitched out, and worked. These matters will occupy the present paper.

The turning is done in a metal-turning lathe, and the wheel is revolved on an iron mandrel just as though it were running upon its own shaft. The slide rest roughing and knife tools are used for roughing down and finishing. The turning can be done also with wood turner's gouges, and with scraping chisels, but the slide rest work is to be preferred. Light cuts only should be taken, because heavy cutting will split out the wood, the grain of which outside the shoulders of the tenons is necessarily rather weak. During the driving in of the cogs it is very probable that incipient fractures of the wood will have occurred, without becoming visible. At such spots the turning will probably split off pieces of the wood. If so much is broken off a tooth as to leave insufficient for shaping the tooth, then at this stage the broken tooth should be driven out and another substituted, and the turning afterwards proceeded with. In any case there will be a little burring over of the wood during turning, but not sufficient in amount to damage the cog, provided the feed is not heavy and the wood is sound and free from shakes. The turning, to be accurate, should be done with a template like Fig. 47 *A* if a spur wheel, and like 48 *A* if a bevel. The pitch diameter should be marked upon the templates *a a*, and transferred thence to the wheels, and the pitch circles struck round on the faces of the teeth with a diamond point. If striking lines are required for the centers of the faces and flanks of the teeth (see Fig. 52), those also must be struck round while the wheel is in the lathe. It is then ready for marking out.

I think now I had better say nothing for the present about the pitching out of a bevel wheel, but first dispose of the spur wheel, otherwise there may be some confusion between the two.

In gearing of this kind there are three cardinal matters to be attended to—the due proportioning of the teeth, their equal pitching out, and their correct position at right angles with the faces or sides of the wheel rim.

I cannot in this special series go into the wide question of the forms of teeth, and the various methods of striking out. I will only say briefly that in almost all work of this class the cycloidal form is used, and that the only differences between the teeth in ordinary iron and iron-toothed wheels and wooden mortise wheels are these: The teeth on the latter are shorter, thicker, and have no flank clearance. First, they are shorter. If in iron and iron-toothed wheels, the proportions of length to pitch are $\frac{5}{12}$ pitch above and $\frac{7}{12}$ below pitch line; in mortise wheels they are $\frac{1}{4}$ of the pitch above and $\frac{3}{10}$ below pitch line. Second, they are thicker, and have no flank clearance. In iron and iron toothed wheels the thickness of the tenth equals $\frac{6\frac{1}{2}}{15}$ of the pitch, and the teeth in a pair of wheels are of the same thickness, thus leaving a flank clearance. In mortise wheels the thickness of the tooth equals $\frac{6}{10}$ of the pitch, and that of the iron wheel gearing into it $\frac{4}{10}$ of the pitch, thus leaving no flank clearance.

The centers of the cogs have to be divided or "pitched out" upon both pitch circles. Although it may seem an easy matter to set the dividers to the pitch and mark the centers round, it is in large wheels a tedious process, usually requiring several slight re adjustments of the dividers before the last pitch falls into the one from which the dividers started. In large wheels, therefore, the task is facilitated by first dividing the pitch circle into six or eight or a dozen large subdivisions with large compasses or trammels, and then subdividing these sections with dividers for the pitch.

The usual method of obtaining tooth curves is by means of one of the odontograph scales—Professor Willis' in England, or directly by means of generating circles. The latter method is shown in Figs. 49, 50, 51. In these figures *A* represents the pitch circle of the wheel struck on a drawing board, *B B'* a template of wood representing the generating circle, *C* a template of wood cut on concave and convex edges to the same radius as the pitch circle. The same circle being used for generating the cycloidal curves of roots and flanks of the wheels which have to gear together, insures that those roots and flanks shall be perfect envelopes of one another, and that the wheels will consequently gear with the minimum of rubbing, and that the path of contact shall always pass through the pitch point. The template *C* being placed against the pitch circle, the generating circle *B* is rolled to *B'*, and the needle point *a* thrust diagonally through the circle describes in Fig. 49 the curve *b* of the tooth face, and in Fig. 50 the curve *c* for the tooth flank. The nearest approximate radii, *c* and *d*, are adapted to their respective curves, and striking lines *f g* are obtained and transferred to the ends of the teeth, thereby insuring symmetry in all the teeth alike. Fig. 52 shows one of the teeth thus struck out, with the centers of the radii *c c d d* set on the striking lines *f g*. Frequently, however, the flank curves are discarded in favor of parallel flanks, Fig. 53.

The thicknesses of the teeth are pricked off with dividers, Fig. 54, to right and left of the pitch point, and these form the boundary whence the curves of the tooth flanks and faces are struck. The centers from which these flanks and faces are struck were described round the ends of the teeth concentric with the pitch circle, while the wheel was in the lathe, as just now noted, to insure perfect symmetry in the tooth forms; but it may so happen that some of these centers may fall into the spaces between the cogs where there is no hold for the dividers. Then a thin template of zinc, Fig. 55 *A*, is made and moved round as required, and the dividers set upon that.

Some, to save labor, make a template tooth, Fig. 56 *A*, after the centers and thickness lines have been obtained, and placing that upon the ends of the teeth, in its proper position, scribe round its edges. I do not think this method so accurate as the method of scribing lines with compasses before mentioned.

When the tooth centers and tooth forms have been marked out upon one face of the cogs, or when the pitching out only of the tooth centers has been done, the corresponding centers have to be marked upon the opposite face at precise right angles with them. The centers are squared over in several ways, but the following is an accurate and generally followed method.

The lines are first scribed perfectly radial across the ends of several of the teeth at roughly equi-distant positions, say at every 10 or 12 teeth. The lines are scribed either by means of a notched strip, Fig. 57, notched to go down over the rim to rest upon the tooth ends, as in Fig. 58, the lines being scribed along the edge *a*, or radial lines are marked by the simple geometrical method of intersections from equi-distant points, as in Fig. 59, *a a* representing the points for the tooth thickness, *b b* intersections of radii, and *c* the radial center line drawn through those intersections. These lines are carried over the faces either with a tee square, Fig. 60 *A*, or by the method of intersection, Fig. 61, taking a base line *a* across three teeth, to insure greater accuracy. The radii *b b* give by their intersections the vertical line *c*. The squared lines *c* are then carried over the other ends of the teeth, either with the strip, Fig. 57, or by means of intersections, as in Fig. 59, after which the pitching out of the tooth centers and tooth form is done on the second face.

Lastly, lines are scribed over with tee square from end to end of the teeth where the face curves come on the outer diameter. These afford a guide during the working out.

The cogs are cut out mostly with gouge and chisel, the rebate plane being only of service for finishing off the termination of the faces. At the beginning, the paring

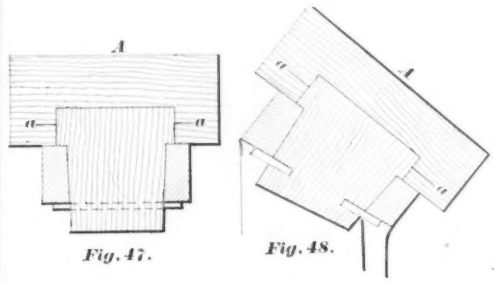


Fig. 47.

Fig. 48.

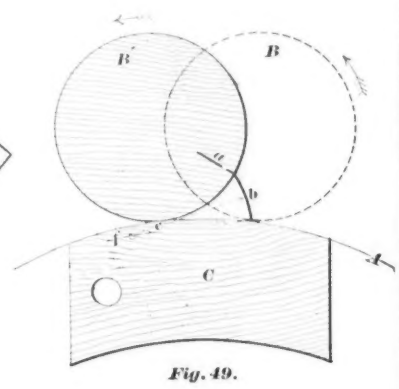
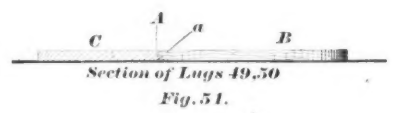


Fig. 49.



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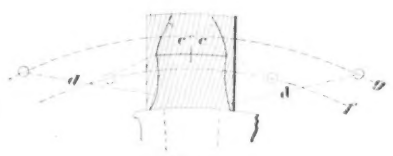

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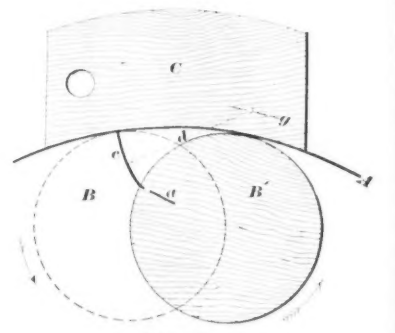

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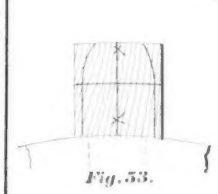
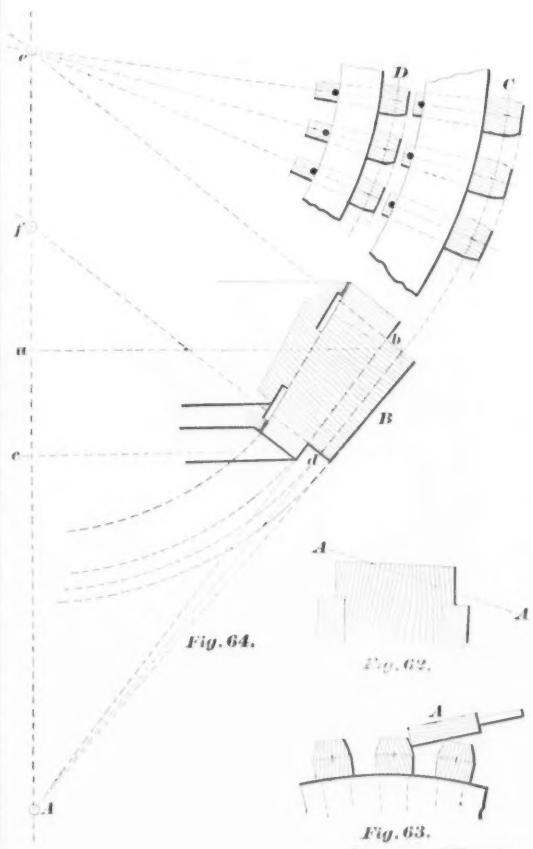


Fig. 53.

Fig. 54.

Fig. 56

Fig. 59.



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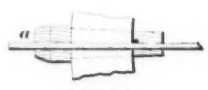

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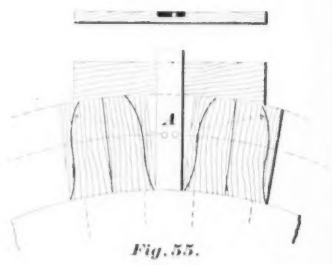


Fig. 55.

Fig. 64.

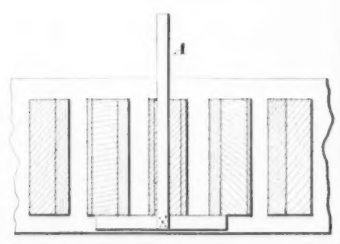


Fig. 60.

Fig. 62.

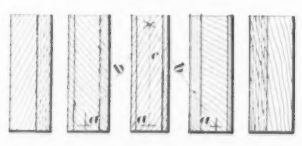


Fig. 61.

COGGING WHEELS.

gouge, chisel and mallet are used to remove the bulk of the wood. As there is risk of the concussion of the blows splitting out the short grain, their direction should be rather diagonally, and away from the rim outwards in the direction of the line *A A*, Fig. 62, and as more and more is removed, inclining to parallel. When the bulk of the stuff has been removed the curves of faces and flanks are set in a little way with paring gouge and chisel, and the edges whitened with chalk or reddened with red lead in oil The flanks and faces are now worked straight across from one side to the other with paring gouge and chisel, and the setting in and coloring of the curves at the ends prevents risk of the lines being cut under with the gouge and chisel. A small, thin, narrow straight-edge is used with coloring matter, to test the straightness of the flanks as the work proceeds—a quite essential precaution when the cutting is done with gouge and chisel, tools which do not possess the initial faculty of guidance possessed by the plane. The plane, as we see, can only be used for the extreme faces, Fig. 63 *A*.

When the teeth are worked accurately nothing more is done to them except to give them a good oiling with linseed oil with a brush or rag. This imparts a slight hardness and a good appearance to the surface.

The marking out of bevel wheel cogs necessarily proceeds on different methods. Still there is no more actual difficulty, but only more time required with the latter.

Since a bevel wheel is a frustum of a cone the tooth centers, roots, points, flanks, and faces all run in exact planes to the apex *A* of the cone, Fig. 64. The shapes of the teeth are marked out accordingly on the drawing from which the wheel is made, and are transferred to the ends of the cogs. I need not go into the details of the operation, but the drawing, Fig. 64, will convey the whole meaning of the process to the mind of a pattern maker. At *B* there is the sectional form of the tooth, and at *C D* the forms and dimensions of their outlines on the large and small diameters respectively are seen projected. The radii are not taken along the semi diameters *a b c d*, but along the projected radii *e b*, *f d*, on lines at right angles with *A e*. These are then drawn at *C D* The thickness of the cogs on the small diameter is obtained by carrying lines from *C* to the center *e*.

The centers of the cogs are pitched round on the large diameter *C* of the wheel just as in the case of a spur; they are carried to the edges at several points and over the faces, and so on to the small ends, by the method of intersecting lines. Then their thicknesses on both large and small diameters are pricked off to right and left of the pitch points, and the curves of flanks and faces struck with dividers. They are worked through by the same methods as the spur wheel teeth; roughed out with gouge and mallet and finished with paring gouge, chisel and plane, and checked with straight-edge.

Small Portable Drilling Machine.

We present an engraving of the No. 3 Colburn portable drilling machine, with patent power transmitter attached.

This size is designed for light work, and will drill holes up to ⅝ inch diameter; the power transmitter can be removed by loosening one set-screw not shown in the cut. This machine is not unlike the hand drilling machines found in almost every machine shop. The advantages of power over hand drilling are too well known to be discussed here.

In this machine the hand crank has been removed and a power attachment applied, by which holes can be drilled in any direction or distance from the countershaft, which is shown in the accompanying cut. The spindle has a feed of four inches and the hole in the end is No. 2 Morse taper. The post is 28 inches long, and the radial arm 10 inches long. The clamp feet open 8 inches between; weight, 35 pounds.

The countershaft consists of a socket, which is first secured to the ceiling or any convenient timber by three lag screws, when the yoke containing the driving pulleys is inserted and fastened by a set screw.

The small grooved pulley on the arm over which the slack side of the rope passes holds the rope up and causes it to encircle nearly the whole of the driving pulley, making it next to impossible for the rope to slip.

It is manufactured by Albert L. Colburn, New Haven, Conn.

Two-spindle Boring and Mortising Machine.

This machine will bore two holes at once, and the line joining the center of the two holes may be at any desired angle to the table, from horizontal, which is the position shown in the engraving, to the vertical, or where one spindle would be vertically over the other.

The table can be set 10″ below the centers of spindles. It slides forward and back against an adjustable stop, and, when ordered for mortising, sideways also. Mortising is done with a revolving tool, cutting on end and side, making a mortise with half-round ends.

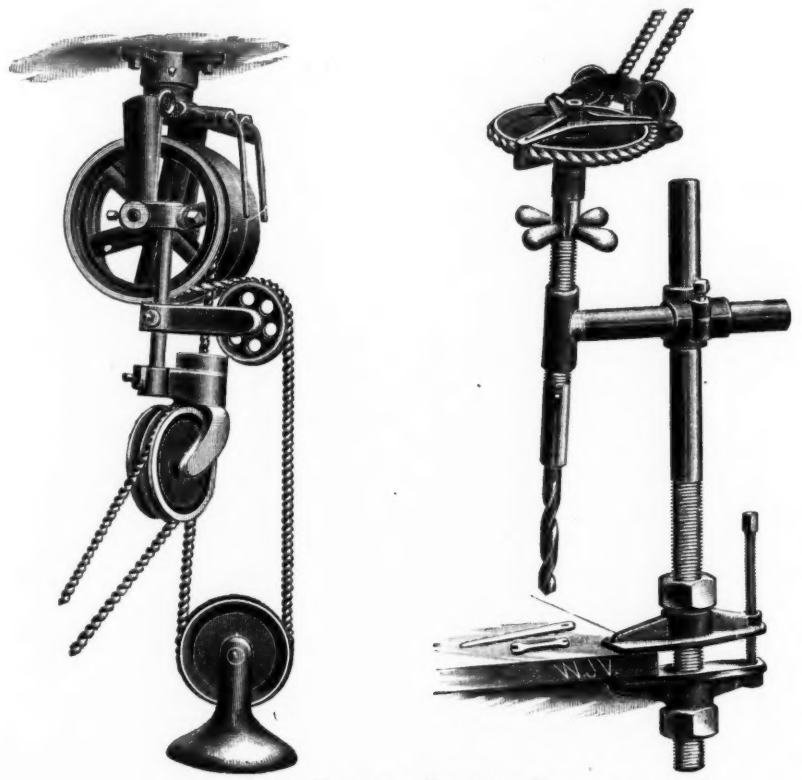
When only one spindle is to be used, the other can be disconnected from the gearing by loosening a single nut. This should always be done for mortising, as the spindle then runs at a much higher speed than for boring.

The spindles and their pinions are of steel, and their bearings are adjustable for wear. Two sizes of this machine are made, as follows:

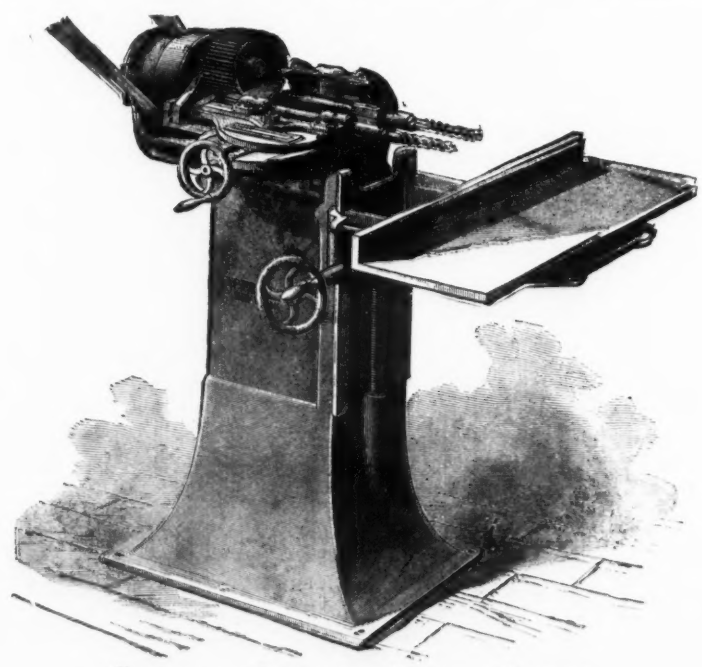
16″ machine, bores holes from 1″ to 16″ between centers. Weight, about 600 pounds. The 5″ machine bores holes from 1″ to 5″ between centers. Weight, about 500 pounds. Either of these machines can be furnished with hand-lever and a treadle. The manufacturer is P. Pryibil, 498–510 W. 41st street, New York City.

Two firemen who were on the steamer "Alice Blanchard" on a trip to the Yukon River brought back two novel Aleut canoes. The boats are made of rawhide supported by horizontal ribs The only opening is a circular hole in the center large enough for a man's body so that he can sit down. A flap of rawhide surrounds the hole, and when the occupant plants himself in the bottom of the craft he draws this flap up, fastening it tightly around his body under the arms. This makes the boat practically watertight, and he can paddle along in the roughest kind of weather without danger of drowning. If his craft rolls over all he has to do is to paw the water until he gets his head to the surface again, and the boat, having stationary ballast, immediately rights herself.

Some of them are made with two holes, to accommodate two passengers. The two brought down are the single pattern. They are about fourteen feet long, thirty inches across, and of a like depth. They are very light and can easily be carried about. The owners are going to keep them at Lake Washington. It is said two men came down from Alaska in one some years ago and had been upset on numerous occasions on the way, but they never suffered more serious injury than getting their shoulders wet.—*Seattle Post-Intelligencer.*



SMALL PORTABLE DRILLING MACHINE.



TWO-SPINDLE BORING AND MORTISING MACHINE.

LETTERS FROM PRACTICAL MEN.

Fly-wheels.

Editor American Machinist:

In the matter of fly-wheel diameter and weight, I like to apply Matthew Baldwin's old rule in locomotive construction: "Make it about right, *and then throw in another ton of iron.*"

With this it is suitable to remember J. A. Fay & Co.'s rule for horse-power to drive wood-working machinery: "A little too much belt power is about enough."

ROBERT GRIMSHAW.

Why Are Gears Noisy?

Editor American Machinist:

In reading "Gascon's Discourses Upon Some Shortcomings in Text-books," by Jarno, I am led to attempt to put a few thoughts of my own on the same subject before the readers of the AMERICAN MACHINIST.

Take any of the text-books that are now published treating upon "Involute Gearing"—all give a theory of constructing the gear tooth, and gears so constructed fail to give good practical results. In fact, some will not mesh at all. What the average machinist wants is this gear question discussed in plain, every-day talk.

Most writers, in explaining the theory of gearing, use technical terms, which, while probably correct, are understood by but few of the mechanics having anything to do with gearing.

The writer is one of that class who represent the practical side of gearing, and what I shall say will be the result of a long and varied practice.

First, I will ask the professors a few questions.

Can they tell us what amount of interference there is in the true involute in a pair of gears, say 3 *P* 19 and 69 *T*, and can they tell how to draw the form of teeth for these gears so they will run smoothly and quietly?

Why do gears make a noise?

How should the teeth bear upon each other to prevent a noise?

Which gear is the best and smoothest running—the 14½°, 18°, 20°, or 24° pressure angle, and why?

I will try to answer these questions in as simple a way as possible.

In regard to the first question, I will say something after I have heard from my learned friends.

Why do gears make a noise?

In most cases pinions are drivers, and when the teeth bear harder at points, and the wheel does the same, a very noisy running gear is the result. Or if pinion bears at pitch line, and wheel bears hard at points, you will get the same result.

If wheel and pinion bear evenly all the way out to points, you will get a fair running gear. The same result will be obtained when pinion bears at pitch line, and slightly above, and wheel very near the points. When wheel bears all the way to the points, and touches fillets in pinion, it will make a noise. In this case, either the fillet of pinion or diameter of gear is too large.

To get a perfect running pair of gears, the teeth of pinion and wheel must bear slightly at points, and continually harder towards pitch line. This condition holds good in any pitch or number of teeth.

In regard to pressure angle, 14½° is the one most commonly used, and it will be hard to suggest another angle to replace it and get as good results. I assert that for 3½ *P*, and finer, it cannot be beaten. The best possible results are attained in both spur and bevel gears by it. In regard to strength for the pitches named it is entirely satisfactory, and gears with 14½° pressure angle will make less noise than gears with greater angle.

I admit that there is more friction in 14½° than in angles greater, but with the latter there are fewer teeth in contact, and the action is not so far each side of the line of centers.

The objection to 20° or 24° is that in case a wheel is driven by a pinion with low number of teeth (and this is usually the case) you will hear a continual thumping as each tooth is brought into contact. This is caused by

the action being too near the line of centers. Another bad feature is that as you approach the rack it makes the teeth too pointed.

With 14½° we do not hear that thumping, because the action is nearer the line of centers. There is a quick, inward motion toward the center.

As the teeth meet each other with less obliquity they have less tendency to push the gears apart, and more of a direct push, and consequently less power is needed to run them, and there is less strain. The life of such gears will be much longer, and the original shape will be retained to a greater extent.

Some makers of gear cutters use a large pressure angle, and make the addendum short. This is objectionable, because it makes a stubby tooth, especially so in wheels with large numbers of teeth.

In my opinion, this is not the proper way. I say make the addendum longer rather than shorter for the best results in nice running gears. Now I would not object to 20° for 3 *P* and coarser, but in these pitches I would suggest that the tooth in pinion be made thicker than the regular one, and the wheel tooth correspondingly thinner, so as to equalize the strength.

For example, $1\frac{1}{2}\ P\ t = 1.0472$ for gear for pinion $t = 1.0872$.

This would make pinion of 12-tooth as strong as teeth in wheel.

But only in cases where strength is absolutely necessary would I suggest the 20° angle, for it is a noisy gear at best, and in case of a small pinion running into a large wheel, it has but one tooth in contact most of the time, which makes it noisy.

A PALE FACE WORKMAN AT THE BENCH.

Emery Wheels.

Editor American Machinist:

Mr. George B. Grant, in the last number of the AMERICAN MACHINIST, has a correct and very forcible protest against the use of emery wheels of the shape which he illustrates. As his criticism might lead many to condemn the use of any annular surface for grinding purposes, and as this use is often convenient and desirable, I inclose sketch showing the construction of the annular wheel used on the twist drill grinder built by William Sellers & Co., Incorporated, of Philadelphia. This wheel is molded, pressed, dried, turned and finished complete in place in its cast-iron plate, and, with the exception of two or three of the original experimental wheels, not one has ever been reported broken, out of hundreds of them in use. The illustration shows also the cover, which forms an absolute safeguard against any injury to the operator or surrounding objects in case an inferior wheel should be substituted. In the event of such a wheel breaking, the loose parts would fly off tangentially and strike the cover at a very acute angle, causing no damage, but being brought to rest by the friction. The cover would act as a brake, except that, instead of the brake being contracted upon the wheel, the wheel would be expanded into the brake. Even if an annular wheel were not particularly desirable, the arrangement illustrated might be adopted, simply for its safety features, in preference to an ordinary wheel, where it would be impossible or difficult to keep a cover in close proximity to the circumference, which constantly diminishes by wear.

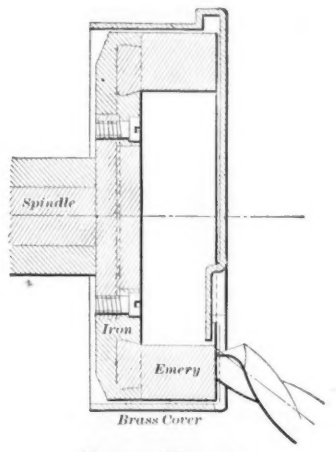
If Mr. Grant possessed a drill grinder with an annular wheel arranged as shown, he would not take any great risk in ho'ding himself responsible for the consequences. He has merely been unfortunate in his selection.

WM. H. THORNE.

Lathes to Cut Standard Threads.

Editor American Machinist:

Referring to Mr. Shellenback's reply to my letter of September 15, I merely wish to say that my object was not to criticise Mr. Shellenback's lathe, but to put in a word in favor of what I believe is a matter of considerable importance to all machinery manufacturers, including lathe builders, *i. e.*, the general adoption of the U. S. standard screw threads. Of course Mr. Shellenback is too well acquainted with mechanical matters to suppose that I am in any way responsible for the fact that 13 threads per inch is standard for half inch bolts, though the tone of his letter would seem to indicate that. William Sellers, the Franklyn Institute, the U. S. Navy, the Master Car Builders Association, Master Mechanics Association, and many of the leading shops of the country, are responsible for this, and the movement in



EMERY WHEELS.

this direction has gone far enough to show that standard threads are of great advantage to all who have anything to do with machinery.

Of course, I do not expect that Mr. Shellenback's or any other 24″ lathe will be used for *manufacturing* half inch bolts, and I know that no lathe of any make or of any swing should be used for such a purpose; but I take it that Mr. Shellenback's lathe is especially well adapted to jobbing work where changes are frequent, and where the work may be anything whatever that comes within its capacity. For instance, it often happens that shafts of considerable length that must be, perhaps, turned in the only 24″ lathe in the jobbing shop, require to be threaded at the end for a nut. This nut should be standard; and suppose it happens to be half-inch, and the lathe won't cut 13 threads? Why, then something else is substituted for standard, and the general adoption of standard threads is that much further away. For this and similar reasons I think all lathes should cut all standard threads within their range for screw cutting. But it is to be noted that the lathe in question is not the only one that does not do this, many of them that cut 13 threads failing to cut other standard pitches of equal importance.

Millionaires are rather rare among lathe builders, as Mr. Shellenback intimates, but they are also among all other manufacturers who are not at the same time something else besides simple manufacturers.

Most manufacturers who are not also monopolists get, in what are called profits, merely interest on money invested, and wages for skilled management, hard work, and responsibility.

S. T. FREELAND.

The Railroads of Costa Rica.

Editor American Machinist:

In your issue of September 8th a railway man from Costa Rica writes some severe strictures upon its line and country, which are only partly true, and about which I will endeavor to give you a more correct impression.

The line was only taken over from the contractor, M. C. Keith (an American) by the English company in July of last year, and they then received a sum of money from the contractor to put the locomotives in repair after they had been used for construction purposes for three or four years. Your practical readers will at all events understand the usage that locomotives get on construction, and in a country like this, sometimes called the Switzerland of America, the case was made worse by the locomotives being cut off by slides, etc., from any workshop for months at a time. One English engine worked nine months without going near the shops, or washing out, and the only repairs during that time were done by the engineer who was driving it, so that when the company took possession the amount of mud burnt fire boxes and repairs necessary to motion, etc., was appalling. To bring things into anything like a satisfactory state with the small staff of mechanics and workshops at the company's disposal was necessarily a work of time, but at the present moment a good on-time passenger and freight service is maintained by the English engines, and there is nothing to complain about their steaming qualities, now that they have been re-tubed and tons of mud removed from their boilers. We all know the desirability of having as much weight upon the drivers as possible, but on a line like that of Costa Rica, cut on the side of a range of mountains, and running for miles with a sheer descent on the other side of 1,500 feet, and with an almost constant succession of 20° curves, it is also a desirable thing to have a good guide in the shape of a heavily-weighted bogie, even if it has to be done at the expense of hauling power.

The dump and shaker grates are not considered a necessity in England with its superior coal, and where the fires are drawn every night, not by dropping the bars, as your correspondent says, but with a long shovel through the fire doors. At the same time I admit that they will be an advantage here, and will no doubt be fitted on the mountain engines now in construction.

There are two distinct climates in this country, and up here we suffer from neither heat nor cold, and the old hands on the Central Division would be sorry to change their lot, although they may give a passing sigh for the succulent oyster or the juicy mutton of the North. Below, near the coast, is simply life in the tropics, and of a rough order.

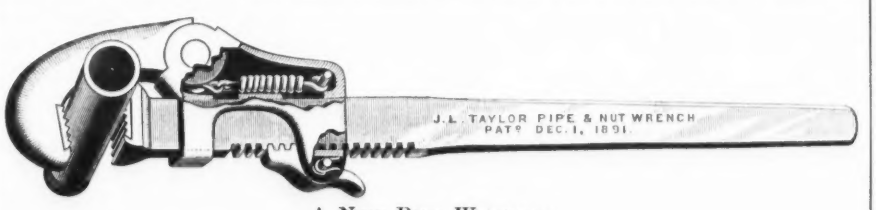
FAIR PLAY.

Tramping.

Editor American Machinist:

In my first I expressed a desire to have this matter discussed, but had no idea that it would receive any attention. However, I am pleased to note that W., and "A Rolling Stone," come out with their views.

W. states that he would like to use a different subject from the one that I picture, and uses a boy with a good head, who likes his work, but who is held back merely because his employer can make more off him. After he sees that there is no promotion for him in that shop decides to leave, so he seeks another place where he can learn. Supposing



A NEW PIPE WRENCH.

he does, and, as "Rolling Stone" says, stays there six months, the question arises as to whether or not he belongs to the class that I picture. I say that he does not, but belongs to the class that *will* get up in the world, and if he does strike a good place he will stick there some time.

If W., and "A Rolling Stone" will read my Talks, they will see that my man never left because he was not learning, but because he thought that, by tramping, or traveling, as you will, he could make more money, and I stick to it that a boy who leaves with such intentions will get left, unless he does awaken to the fact that he must get knowledge before he gets the money.

W. states that his boy does not get stuck on the first job. Neither did mine; but he got stuck before the week was up. Again, he states that no practical foreman will give a new man the best work to do, but, as it happens, my man got stuck on a simple job.

"A Rolling Stone" and W. both end up by giving some advice to the boys; the former writer says: "Let no one take the foregoing as a recommendation to tramp unless compelled to. Still, if forced to it, do not despair of success."

The latter writer says: "Do not leave one shop for another till you see some benefit for a change." Under these circumstances I would tramp some myself.

A PRACTICAL MACHINIST.

Tempering Steel—That Chinese Bell.

Editor American Machinist:

I have noticed, from time to time, articles in the AMERICAN MACHINIST on the treatment of steel.

These articles are very interesting to me, and, when possible, I always give any method of treating steel new to me a trial.

I have the greatest trouble in getting two orders of the same kind of steel alike. My method of tempering milling cutters is to heat them in a charcoal fire to a low red, then dust them with powdered prussiate of potash, return to the fire, and heat up to a dull red and dip in strong brine. I take care to take the chill off the brine in cold weather, and think I can harden a cutter by this method at a lower heat than any other I have tried.

I want to say a word in regard to Prof. Sweet's article on boasting. I think the Professor would have done a great deal more good if he had taken the trouble to find out how that little bell was made. From his description he must have seen the blacksmith, as he minutely describes his kit.

I am very sure that there are a great many Yankees that would sit up nights to see the job done, and never leave China until they saw it.

JEWETT.

A New Pipe Wrench.

We give with this an illustration of a new pipe and nut wrench invented by Mr. J. L. Taylor Parts of the sliding jaw are represented as broken away, to show the construction of the wrench.

As will be seen, the wrench consists essentially of a plain bar handle, which is drop-forged of steel, and has fitted to it a sliding jaw, which is held in any desired position by means of a multiple-toothed pawl or lock which engages with teeth formed upon the back of the handle, the form of these teeth, together with the fact that several of them are always in use at the same time, giving them ample strength. This pawl snaps into place by the action of a spring when released, and when raised allows the sliding jaw to be instantly moved along to suit any pipe or other object which is to be gripped. Attached to the sliding head is a swinging jaw, which is pivoted as shown, and held in place ready to grip the pipe by the spiral spring, which is shown within the sliding head. This spring needs only to support the weight of the hinged jaw under certain circumstances, the jaw being, of course, self gripping upon the pipe.

The gripping teeth are formed upon small plates of the best tool steel, which are accurately made to gauge, so that new ones may readily be inserted, to take the place of those that may have become dull or broken. These are oil tempered.

With any one adjustment the wrench will grip a pipe and its coupling or two sizes of pipe, and it will also readily grip square, hex., or almost any irregular shaped piece, and always releases its hold readily.

The firm of C. H. Redman & Co., 216 High street, Newark, N. J., have put down a plant of special tools for making these wrenches in the best manner and with interchangeable parts. They are finished all over, and are at present made in four sizes, to grip pipe up to 2½″, and it is expected that larger sizes will be soon made.

It is believed that a brass trust has been formed in Connecticut that will control the price of brass goods, in spite of competition.

How the record of railroad wrecks goes on. Wrecks come about, if we could believe the reports, because men are careless.

AMERICAN MACHINIST

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An Explanation by Mr. Dredge.

We have before referred to the fact that some sort of a misunderstanding had arisen between the World's Fair management and the Royal British Commission regarding the attendance of the latter at the dedication ceremonies. The light in which this misunderstanding will be regarded in England is shown by the following extract from an editorial article in *Engineering* of Oct. 14. It should be remembered in this connection that Mr. Dredge, who is one of the editors and proprietors of *Engineering*, is a member of the British Commission, and has done an incalculable amount of work to further the interests of the exhibition on the other side, his paper having devoted far more space to the illustration and description of the buildings at Chicago than all the technical papers of America combined. We are not sure that he is right in thinking that the trouble has been brought about by those who think to affect votes in the coming election thereby, and do not understand how, if at all, politics are concerned in it; but, at any rate, we very much regret that anything should have been said or done that might lead so good a friend of America and of the exhibition to think such a thing. The quotation to which we refer is the concluding paragraph of an editorial article, and is as follows:

"It is perhaps to be regretted that the fever of the presidential election is nearing its height in the United States just at the time of the dedication ceremonies of the exhibition. We do not pretend to any knowledge of American politics, and may, therefore, be easily led into profound error. But we cannot dissociate from the unusual conditions that precede a presidential election, the efforts that have been successfully made to prevent a representative delegation of the British Royal Commission from being present at the dedication ceremonies, nor the alarming statements that have been circulated in Germany, regarding the almost prohibitory rates to be charged for the transport of certain exhibits, chiefly textile goods, and which for the moment seem to jeopardize the success of the whole German section. The aim of such diplomacy may be to win votes by exciting prejudice or alarming financial interests, and, having served its turn, it drops out of sight and is forgotten. Our conjectures may be wholly wrong, and if so we shall be pardoned on the ground of ignorance, but we prefer to regard these and other indications as the natural products of an abnormal period; to do otherwise would, we think, be an injustice towards a great and generous people."

The Unreliability of Statistics.

The Federal census returns relating to Philadelphia's industrial interests are being very severely criticised by those who may be supposed to be in the best possible position to know something of the matter. Politics are having altogether more to do with the compilation of industrial statistics, and with the criticism of them, than ought to be the case, but at least two of Philadelphia's leading papers, which are so situated as not to be at all likely to be influenced by such motives, agree in declaring that the recently announced figures of the "industrial census" of that city must be entirely unreliable and misleading. The *Philadelphia Ledger* comments upon it as follows:

Although it is not possible to take up Superintendent Porter's census of the manufacturing industries and say what figures are wrong, it is abundantly evident that the returns are worthless. Whether the fault is with the returns for 1880 or the returns for 1890, comparison of the two returns shows that there is gross error somewhere. The 1890 returns would be flattering enough to Philadelphia if we could believe that, with an increase of population of about 25 per cent., there was a gain of 96 per cent. in the number of establishments reported, of 91 per cent. in the capital employed, of 33 per cent. in the number of hands employed, of 103 per cent. in the wages paid, and of 72 per cent. in the value of the products. Such an enormous percentage of growth in manufacturing industries may be possible in small towns, but not in great industrial centers. A village with one mill gains 100 per cent. when another of the same size is erected, but these returns represent that the great industrial establishments of Philadelphia existing in 1880 have been doubled in number and capital, and nearly doubled in capacity in the last ten years. This is not only incredible, it is virtually impossible. Whether the fault is with the returns of 1880 or those of 1890 does not matter much, for they are of little value, except relatively, to show the growth of industries. Similar, but even more exaggerated returns have been published of New York City, all the percentages of increase being larger than for Philadelphia, except cost of materials used, population and value of product at works.

The only value of Superintendent Porter's census of manufactures appears to be in its complete demonstration that the government cannot take such a census and obtain reliable data. It is a waste of money to compile and publish such statistics as these, for they will not be accepted as true.

The *Philadelphia Telegraph* says:

..... The gist of the whole matter is that neither the government nor any other authority is competent to make such an inquest into private affairs as this sort of census-taking necessarily involves. Business men cannot and will not give to the public the information demanded. It is a piece of impertinence to make such a demand, and if the impertinence is not sharply resented, it will be disregarded and treated as a nuisance to be staved off and gotten rid of with as little trouble as possible.

A more convincing proof, however, is found in a statement of Mr. Henry W. Cramp, who calls attention to the fact that the figures for Philadelphia shipbuilding give the number of establishments in the city engaged in that industry as 20, the total amount of capital invested, $1,291,776, and the entire annual product, $959,123. Of course every one knows that such a report for a town containing such a plant as that of the Cramps' is simply absurd, and Mr. Cramp declares that in the firm's report the value of its plant was given at practically $3,000,000, and that the product of the plant had been in one year $3,346,000. The glaring errors which have been shown to exist in this report are no argument against any particular political party, or against any particular administration, but they simply show that all such figures must, in the nature of things, be more or less unreliable, and must be accepted and used only with a liberal allowance for error, or must be modified by expert knowledge of the industries to which they relate. It has been shown many times, in many different countries, and by statistics relating to many different subjects, that anything which it is desired to prove can be proven by statistics. For instance, statistics prove to the entire satisfaction of many thousands of people that vaccination has done very much to decrease small-pox. But there is an anti-vaccination society in existance that claims to be in possession of statistics that show conclusively that vaccination has done nothing whatever toward abating small-pox, while it has done much harm in other directions. Statistics are very apt to be misleading, even when those who compile them desire to know only the truth and are entirely unbiased by any wishes as to how they shall turn out, or by any previously conceived opinions. They are much more misleading when these conditions do not exist.

By the recent failure of the Buffalo Tencent Permanent Savings and Loan Association, a large number of poor people who work hard and deny themselves of what many consider actual necessities of life, in order to save a few dollars, have lost a good share, if not all they have been able to save for some time past. Gross mismanagement on the part of the officers who had charge of the funds is alleged as the reason for the failure, but there is evidence to show that many of the later schemes for using the savings of working people, and getting abnormal returns from them, are unsound in principle, and cannot succeed. The original building and loan societies were conceived and managed upon conservative lines, and many of them are now doing as well as ever they did; but new financial schemes, especially those which are intended to appeal particularly to working people, should be examined with great care before going into them. And it should be remembered that it is almost an invariable rule that, where there is a chance of very large returns from capital invested, outside of some form of monopoly, there is a corresponding risk of losing all that is invested.

Savings banks are all right so long as they are well and honestly managed, but bitter experience shows that they are not by any means always well and honestly managed, and that sufficient safeguards are not usually thrown about them. It seems strange that we should not adopt a plan that in England has been working well for some years. By this plan the post-offices of England sell special stamps of small denominations, which are pasted in books by the purchaser, and, when they amount to a certain sum, are exchanged for another form of investment if desired. A small rate of interest is paid, but the main thing is that the investment is as safe as the government itself, and a saver of small amounts can know that, so long as the government has an existence at all, he can get his money on demand. Such a scheme in use here would enable the people to save money with the certainty of getting it when wanted, and, at the same time, would enable the government to place its loans at a lower rate of interest than that now paid.

Most of our technical contemporaries are publishing more or less lengthy accounts of the ceremonies attending the dedication of the World's Fair buildings at Chicago, most of these accounts being evidently made up from the regular press reports published in the daily papers, and which we will spare our readers a repetition of, in the full belief that they have already read all they care to read of it. An AMERICAN MACHINIST man was on the ground, however, and we shall in the future, as we have done in the past, publish such information relating to machinery interests in connection with the exhibition as we think our readers would be interested in. The dimensions and general arrangements of Machinery Hall were given in our issue of May 19, and we shall shortly publish something further of interest concerning this department. Concerning the dedication there seems to be nothing to say further than that it fully met the expectations of those who have noted the tremendous energy and enterprise of those who have had matters in charge there, and all who attended have been more than ever impressed with the belief that the exhibition is to be in many respects the greatest in history.

A good plan of preventing tools from rusting is the simple preparation employed by Professor Olmstead, of Yale College, for the preservation of scientific apparatus, and which he long ago published for the general good, declining to have it patented. It is made by the slow melting together of six or eight parts of lard to one of resin, stirring till cool. This remains semi-fluid, ready for use, the resin preventing rancidity and supplying an air-tight film. Rubbed on a bright surface ever so thinly it protects and preserves the polish effectually, and it can be wiped off nearly clean, if ever desired, as from a knife blade; or it may be thinned with coal oil or benzine.

We have received from the Wells Memorial Institute, of Boston, a copy of its prospectus for the season 1892–3. To judge from it, we should say that workingmen of Boston and vicinity, for whom the institute is especially maintained, need not be at a loss for a way to spend a very pleasant and profitable evening during the coming winter.

A New York paper contains the account of the arrest of a man for "loitering." His appearance was so ragged and dirty that he was about to be committed to the workhouse for vagrancy, when he pulled from a bundle, which he carried under his arm, $17,500 in the form of deposits recorded in five different banks. He was immediately discharged. From which it appears that

loitering in itself is not a crime, and only becomes such when done by a man who has no money; or, in other words, that a man who has money in his pocket may do with impunity the precise thing that another who happens to have no money will be jailed for doing. It would seem to the lay mind as if a ragged and dirty loafer was an objectionable person, whether he happened to have $17,500 in his pocket or not.

It is announced that, through the liberality of Mr. Charles T. Yerkes, of Chicago, that city is to have a telescope which is to surpass the Lick instrument in size and quality, if possible. It is hoped that the glass of this instrument will be 45″ aperture as against the 36″ of the Lick instrument. It will be part of the equipment of the Chicago University. There is a vast difference between the conditions for astronomical observations on Mount Hamilton and those at Chicago, and it may be found that the Chicago instrument will need its 11″ superior aperture to give as good results as the Lick instrument.

A Boston clergyman member of the Antitenement House League of Boston, recently visited New York city to investigate the tenement house clothing factories and the sweating system. He reported on his return home that there were streets in this city that were far worse than any he had seen in London, Paris, Berlin, or even Constantinople, all of which cities he had visited, and had taken pains to inspect the slums of.

We are informed that some of our readers who have addressed letters of inquiry regarding the Reflection Liquid Gauge, referred to in our issue of Sept. 22, have had them returned from the Boston post-office unopened. The address given by the circulars of the company is, The Reflection Liquid Gauge Company, 178 Devonshire street, Boston, Mass., and a letter so addressed should reach them.

An elegant illustrated pamphlet, entitled "Inventive Progress," has been issued by Wm. A. Rosenbaum, *Times* Building, New York City. It contains much information and many illustrations of interest to inventors and mechanics.

Some of our readers have inferred from a brief notice in a recent issue that we furnished catalogues of technical institutes. Our intention was simply to advise them to write to such institutions for catalogues.

Literary Notes.

THE COLLEGE FRATERNITY is a new magazine, which is published in the interest of college fraternities generally, and in its first number, which lies before us, very much of interest will be found by those of our readers who are members of any Greek letter society. It is edited by Mr. Eugene H. L. Randolph, whose father was a well-known mechanical engineer, and who himself has been connected with a manufacturing business. The new magazine is very well illustrated and printed, and should meet with a favorable reception. It is published by the Fraternity Publishing Co., 171 Broadway, at $2 per year.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(461) P. G. F., Cincinnati, Ohio, writes: Kindly send me some catalogues of schools in which mechanical engineering is taught. *A.*—We do not keep catalogues for distribution. Any of these institutions will take pleasure in furnishing you with a catalogue. The addresses of some of them are given in answer to Question 239, in our issue of June 2 current volume.

(462) W. C., Springfield, O., asks: Could you tell me through your columns of a good book treating on metal pattern making? *A.*—We do not know of a work that treats exclusively on this subject. A few pages are devoted to it in "Pattern Making," by a foreman pattern maker, published by Crosby, Lockwood & Co., London.

(463) J. J. H., Plainfield, N. J., writes: The questions under discussion are: Can a lathe be made to turn square? Is it practical? And would it take the market? Please answer. *A.*—Devices have been attached to a lathe to make it turn square. The practicability of such devices depends on their efficiency compared with that of other machines made specially for forming square bars. The fact that lathes are not rigged for the purpose of turning square indicates that, so far, such attachments are not practical, and consequently there is no market for them.

(464) C. D. B., Springfield, O., writes: I would like to have your opinion in regard to the repair of a boiler, in which we have to put in a set of new flues. The metal between the flue holes in the back head is cracked in two places. The holes near the injured part have been plugged for two years, and did not show any leaks. Would you go to the expense of putting in a new head? The boiler is 5 feet diameter, with eighty 3-inch flues. *A.*—We should put in a new head; under no condition would we allow a broken flue-sheet to remain. Boilers are dangerous things to fool with, and carelessness or stinginess in the repair of boilers should not be permitted.

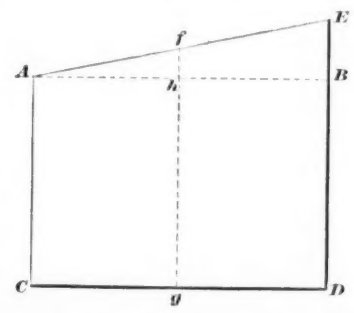
(465) R. B.D., Ware, Mass., writes: Please give me the information in regard to the following: There are several machine tools here, which have become rusty, and oil and grease have become hardened on them. What would be the best way to remove the grease? Is there any liquid preparation that would do it? *A.*—Try benzine. 2. How would you mix, and what color of paint would you put on the tools after they have been cleaned, and will I have to scrape off the old paint? *A.*—Whether the old paint will have to be scraped off or not will depend on the kind of paint previously used and its present condition. Any good painter will advise you on this subject and the manner of mixing the paint. The color is a matter of taste. We prefer a steel-gray color.

(466) F. J. R., Galveston, Texas, writes: Can you kindly recommend a book treating on laying out the work of small slide-valve engines? I am a young man, and have been working in a repair shop for some time and now have a chance of building an engine, and would like to have some kind of a book to help me along. *A.*—There are many books published on the design of the steam engine, but it is extremely difficult to recommend a book to strangers with whom we are not acquainted, and know nothing of the knowledge they already possess. Even if we did recommend a book, it would probably be of little use, unless considerable time is spent in its study. You must not expect to become a good steam engine designer without giving much time to study and making yourself thoroughly acquainted with subjects relating to the steam engine, for which more than one book will be required.

(467) F. D., Bloomfield, N. J., asks: Which is the front side of an anvil—the side on which the smith works, or the side on which the helper works? *A.*—We referred this question to B. F. Spalding, who replies as follows: "I would say that I have never heard it doubted that the side towards the helper is the front side. The doubt is ingenious, and institutes an analogy between the smith's forge, tool bench, and anvil. If he stands in front of his forge and tool bench, how is it that he is not also in front of his anvil? I think, however, that it is generally conceded that the 'front' side of an object is the side facing the direction from which visitors approach; it is so with a carpenter's bench, a machinist's lathe, a sample room bar, a dry goods counter, etc. The front side is not the side towards the party who stays, but the side towards the party who comes. As visitors approach an anvil from the helper's side, makes this side the front one."

(468) W. E. T., Rutland, Vt., writes: Please give me through your columns the shortest solution of the following problem: I wish to prepare a table to show the amount of liquid contained in a tank 24½ feet long and 61 inches diameter inside, at successive quarter inches from the top to the center, so that when a certain amount is drawn out, I can, by measuring from the top of tank to top of liquid, tell just the quantity remaining. *A.*—Multiply the length of the tank in inches by the area in square inches; the product will be the contents of the tank. Thus, the length is 294 inches, the area is 2,922.5 square inches, and $2{,}922.5 \times 294 = 859{,}215$ cubic inches. There are $294 \times 4 = 1{,}176$ quarter inches in the height of tank, and consequently for each fall of ¼ of an inch there will be $\frac{859\,215}{1{,}176} = 730.625$ cubic inches of liquid discharged, leaving $859{,}215 - 730.625 = 858{,}484\,375$ cubic inches for the fall of ¼ inch; $859{,}215 - (730.625 \times 2) = 857{,}753.75$ for a fall of ½ inch, and so on. Should you wish to have the result in gallons, proceed as follows: There are 231 cubic inches in the gallon; hence the tank when full contains $\frac{859{,}215}{231} = 3{,}719.545$ gallons. For each quarter of an inch of fall in the liquid $\frac{730.625}{231} = 3.162$ gallons, will be discharged; hence, for the fall of the first quarter of an inch there will remain $3{,}719.545 - 3.162 = 3{,}716.383$ gallons in the tank, and so on, for other depths of fall. If there are braces in the tank, allowance should be made for the space taken up by them.

(469) R. D., Newburyport, Mass., writes: We have the following mechanical problem: The area of trapezoid, as shown in the accompanying figure, is 90 square inches, the length of the side *A C* is 9 inches, and *A B* to *B E* is as 20 to 1; find the length of the side *C D*. It is evident that only a certain dimension will satisfy the conditions, but I have great difficulty in determining the



length of *C D*. *A.*—The area of the trapezoid is found by multiplying the length of the side *C D* by the mean height *f g*, or by half the sum of the lengths of the sides *A C* and *D E*. Now, according to the conditions given, *h f* is equal to $\frac{1}{10}$ of *C D*. Let x denote the length of *C D*, then *h f* will be equal to $\frac{1}{10}\,x$; *A C* we know to be 9 inches long, hence the mean height *g f* will be $9 + \frac{1}{10}\,x$; and the area of the trapezoid will be equal to $(9 + \frac{1}{10}\,x) \times x$. This gives us the following equation:

$$(9 + \tfrac{1}{10}\,x) \times x = 90;$$

clearing of fraction, and reducing, we have:

$$x^2 + 360\,x = 3{,}600;$$

from this we get:

$$x = 9.736+ \text{ inches},$$

which will satisfy the given conditions.

(470) P. B., Houston, Texas, writes: Kindly enlighten me on the following, through your paper: I am classifying locomotive engines, and among other things I am required to give the tractive power for each class. To do this it is necessary to know the average pressure in the cylinder during the stroke when the throttle is wide open, and the engine carries its full pressure, I suppose. What would be the simplest way of determining this average pressure without the use of the indicator? *A.*—In computing the mean effective pressure, for the purpose of finding the tractive force of a locomotive, the throttle valve is supposed to be wide open, so as to obtain as near as possible an initial pressure in the cylinder equal to that in the boiler, and the link motion is supposed to be in full gear. Under these conditions, when running, the initial pressure in the cylinder will generally be a little less than the pressure in the boiler, say 5 pounds; this reduction is due to friction in the pipes and passages, and sometimes to a slight condensation. It should also be remembered that, in computing the mean effective pressure, the absolute pressure should always be taken into account; the latter is equal to pressure indicated by the steam gauge plus 14.7 pounds, or, in round figures, 15 pounds. To find the mean absolute pressure, add one to the hyperbolic logarithm of the ratio of expansion, divide the sum by the ratio of expansion, and multiply the quotient by the absolute initial pressure in the cylinder. Thus: Suppose the boiler pressure is 120 pounds, as indicated by the steam gauge, the initial pressure in the cylinder will then be, say, $120 - 5 = 115$ pounds, and the absolute initial pressure will be $115 + 15 = 130$ pounds. Now we shall assume that steam is cut off at ⅘ of the stroke; the ratio of expansion will then be $4 \div 3 = 1.3$; the hyperbolic logarithm of this number—which you can find in tables given in nearly all engineers' pocket books—is 0.262; adding 1 we have 1.262, and the mean absolute pressure will be:

$$\frac{1.262}{1.3} \times 130 = 126.1 \text{ pounds};$$

subtracting from this the absolute back pressure, say 18 pounds, we have $126.1 - 18 = 108.1$ pounds for the mean effective pressure. This is only a close approximation, because the clearance is not taken into account, but at such a late cut off this will not affect the result much. Many engineers take a shorter course, by simply taking 80 per cent. of the boiler pressure, thus: if the boiler pressure is 120 pounds, then $120 \times .80 = 96$ pounds mean effective pressure; this is somewhat less than found by the first rule, but agrees better with actual pressure when the engine is running with the links hooked up to a certain extent, and is preferred by some engineers in computing the tractive force. After the mean effective pressure has been decided upon, then the tractive force is found by multiplying the square of the diameter of one cylinder in inches by the mean effective pressure, and by the stroke in inches, and dividing the product by the diameter of the driving wheels in inches, the quotient will be the tractive power; the latter may again be limited by the adhesion of the drivers and rail. The adhesion is generally taken at ⅕ of the weight on the drivers, and in well-designed engines this should be numerically equal to the tractive force.

BUSINESS SPECIALS

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"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

A Few Recipes and Hints on the Protection of Bright Steel and Iron.

A solution of india rubber in benzine has been used for years as a coating for steel, iron and lead, and has been found a simple means of keeping them from oxidizing. It can be easily applied with a brush, and is easily rubbed off. It should be made about the consistency of cream.

Bright steel articles in a drawer can be perfectly preserved from rust by putting a lump of freshly-burnt lime in the drawer or case in which they are kept. If the things are to be moved—as a gun in its case, for instance—the lime should be put in a muslin bag. This is especially valuable for specimens of iron when fractured, for in a moderately dry place the lime will not require renewing for many years, as it is capable of absorbing a

large amount of moisture. Articles in use should be placed in a box nearly filled with thoroughly slaked lime. Before using them, rub well with a woolen cloth.

The following mixture forms an excellent brown coating for preventing iron and steel from rust: Dissolve two parts crystallized iron chloride, two antimony chloride, and one tannin in four of water, and apply with sponge or rag, and let dry. Then another coat of paint is applied, and again another if necessary, until the color becomes dark as desired. When dry it is washed with water, allowed to dry again, and the surface polished with boiled linseed oil. The antimony chloride must be as nearly neutral as possible.

To keep tools from rusting, take ½ oz. camphor, dissolve in 1 lb. melted lard, take off the scum, and mix in as much black lead (graphite) as will give it an iron color. Clean the tools, and smear with this mixture. After twenty-four hours rub clean with a soft linen cloth. The tools will keep clean for months under ordinary circumstances.

Another plan is to take one quart freshly-slaked lime, ½ lb. washing soda, ½ lb. soft soap in a bucket, and sufficient water to cover the articles. Put in the tools as soon as possible after use, and wipe them up next morning, or let them remain until wanted.

Another varnish adopted by some is made by mixing slowly together 6 oz. or 8 oz. lard to 1 oz. resin, stirring till cool. When it is semi-fluid, it is ready for use. If too thick, it may be further let down by coal oil or benzine. Rubbed on bright surfaces, ever so thinly, it preserves the polish effectually, and may be readily rubbed off.

A good protecting paste may also be made by slaking a piece of quicklime, with just enough water to cause it to crumble in a covered pot, and while hot adding tallow to it, and working into paste.

Olmstead's varnish is made by melting 2 oz. resin in 1 lb. fresh sweet lard, melting the resin first, and then adding the lard, and mixing thoroughly. This is applied to the metal, which should be warm, if possible, and perfectly cleaned. It is afterwards rubbed off.—*Practical Engineer.*

Long-distance Telephony.

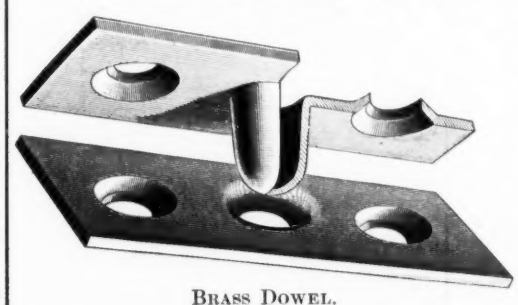
The tendency towards long-distance telephony is becoming more pronounced, and this fact is amply shown by the inauguration at the beginning of this month of a line between Vienna and Trieste, Graz being included. The charge for an ordinary conversation of three minutes between the two former towns is about 3s., whilst between Vienna and Graz, or Graz and Trieste, the rate is about 2s. The opening of this line, which is 314 miles long, is an event of importance in interurban telephony, and it is interesting to note that the length of the line is only exceeded by one other in regular operation in Europe—that is, the Paris-Marseilles, about 620 miles long. The next in importance is the London-Paris service, 310 miles; the Berlin-Breslau line, 219 miles; Vienna-Brünn-Prague, 219 miles; and the Paris-Brussels, 198 miles. It is noteworthy that the line from Vienna to Trieste was commenced in June of last year, when eight sections were proceeded with simultaneously, and was completed at the end of August last, when the first conversation took place. The transmission of speech over the line is said to be remarkably plain and clear, and good results have been obtained over even longer distances.—*Mechanical World.*

A New Launch Engine.

A launch, equipped with one of Root's oil engines, has lately been tried on the Thames, and the results of the trials appear to show that this motor is especially suitable for this particular purpose. This motor, though occupying only a few feet of cubic space, and weighing no more than 6 cwt., developed something over 3 H. P., and drove the launch at the speed of six miles an hour. The novelty of this engine consists mainly in the mechanical contrivances by which ordinary paraffine oil is converted into gas. A small reservoir containing 2 gals. of mineral oil, which is enough for a run of three hours at full speed, is attached to the engine. From this, one drop at a time descends through pipes to valves into which heated air is admitted. The air and oil are forced into a space which, by contact with the flame from another jet of oil, is kept always at an even temperature. There the oil is converted suddenly into gas, and passes through a tube to the piston cylinder. By a system of compensating spring valves, on which the lever strikes, gas is admitted into each of two cylinders alternately, and so the motion once begun goes on so long as there is a drop of oil left in the reservoir, unless it is desired that the engine should stop, and then the man in charge has it perfectly under control. In place of an ordinary fire there is merely an oil lamp, into which is inserted a gas burner of peculiar form. From another cylindrical reservoir oil passes to this burner through a siphon and oozes through a small hole scarcely larger than a pin's point. There it becomes converted into gas, and supplies all the heat that is necessary for driving this engine.—*Mechanical World.*

Brass Dowel for Patterns and Core Boxes.

Last week we described a metal pin stamped from sheet brass, but inadvertently described it as a pin for foundry flasks. The error was entirely on our part, and we correct it in this issue by republishing the



BRASS DOWEL.

cut, and stating its use. It is cheap, and, we should think, admirably adapted to its purpose, which is for patterns and core boxes. The manufacturers are Timmis & Clissold, Bound Brook, N. J.

A Sugar Trust Boycott.

The Boston *Advertiser* says: "The American Sugar Refining Company, otherwise the Sugar Trust, has been flagrantly violating the Federal Anti-Trust law in its dealings with M. P. Longley, a Lynn grocer, who does $200,000 worth of business every year, and whose business integrity and credit is unquestioned.

"The Sugar Trust has boycotted Mr. Longley, so that for days at a time he has been unable to supply his customers with sugar. It has done this because he proposes to retail sugar at five cents a pound instead of six, the card price, which the Trust imposes on retail dealers.

"United States District-Attorney Allen assured the *Advertiser* that if, upon examination, the evidence against the Trust proves adequate, prosecution will follow. He will examine into the case at once."

Explosion of Boilers in a Mill.

A Pittsburgh dispatch says: At 6:30 this morning, just after the night turn had left the mill, and before the day men had reported for work, two large boilers in the Carbon Iron Works, at Thirty-second and Smallman streets, exploded with terrific force, scattering pieces of the boilers, bricks, etc., throughout the mill, in which several hundred men are employed during working hours. The mill was also filled with scalding steam and natural gas, which escaped from the broken pipes and then exploded, causing nearly as much damage to building and machinery as did the collapse of the boilers. The damage to the works will amount to several thousand dollars. No one was killed, and, so far as is known, no person was seriously injured. The escape from fatal results is remarkable.

Cross Stylographic Pen.

In regard to an item published in our issue of September 29, a correspondent sends the following:

Permit me to add the following to your comments upon the use of the "Cross" stylographic pen for drafting purposes. The pen, being acid proof, is well adapted to use red or any ink of a corrosive character.

Any draftsman can appreciate the above advantage over the ordinary drawing pen.

It may be of interest to state that the pen can be made to suit any individual preference as to width of the line drawn, etc.

As a machinist, I think the above will be of general interest to many, like myself, who are old subscribers to the AMERICAN MACHINIST. ROBERT I. CLEGG.

A friend sends us the following clipping from the *Chicago Evening Journal*, which we reprint with the headings as it appeared:

Has He Found It?

A WINNIPEGGER'S INVENTION FOR PERFECT MOTION WHICH MAY ASTONISH THE WORLD.

William Crook, Sr., of this city, informs the Manitoba *Free Press* that he is the inventor and patentee of perfect motion, the principle of which is revolving reciprocative axial action between two revolving oblique pressures, one of these pressures in a wheel with a progressive axle being caused by its revolving pressure on the earth, and the other by the bearings of auxiliary wheels in an oblique position on the axle of the truck wheels; these auxiliary wheels being rapidly fixed to the vehicle and receiving its weight; the same being under the control of the driver by the action of screws, which place and hold the auxiliary wheels in any desired position, thus causing motion to the axle of the truck wheels by the applied rolling gravity pressure of the vehicle and its load. The inventor has also made other discoveries of interest to the mechanical and scientific world.

We should say that this not only "may astonish the world," but that the mere reading of this account certainly will astonish all that part of the world that knows anything of mechanics. We hope, however, that the other discoveries mentioned will not be given to the world until we have time to somewhat recover from the shock caused by the announcement of this one.

A dispatch from Memphis, Tenn., is as follows: An attempt was made last night to wreck the out-going Louisville train on the Chesapeake & Ohio Road at the yards just north of the city limits. Attached to the train was a special car containing President Stuyvesant Fish, Vice-President Willing, Second Vice-President Harriman, E. H. Harriman and Charles H. Peabody, Jr., directors, who were returning North from a southern trip. At the scene of the attack is a lever switch. This the engine and two front cars passed safely, but the first sleeper and the special car ran off, fortunately, however, without injuring any of the occupants beyond a few bruises. The switches had been misplaced, but when or by whom it was done none of the yardmen can tell. They are satisfied that it was done with the design to throw the train off the track.

A Pittsburgh dispatch says: As the Allegheny Republican Club was marching along Smithfield street at about ten o'clock this morning, on its way to the Baltimore & Ohio Depot to take a train for Wheeling, the paraders were run into near the Monongahela House by motor car No. 10 of the Birmingham line. Four of the marchers were struck and seriously hurt. One of the number lost part of a hand under the wheels. The members of the club attacked the car and smashed the windows with their canes. Some one hurled an iron bolt from the car at the attacking mob, but no one was hurt. The club then attacked the motorman, but he escaped.

The following directions for joining band saws are given by the Defiance Machine Works: Bevel each end of the saw the length of two teeth. Make a good joint. Fasten the saw in brazing clamps with the back against the shoulder, and wet the joints with solder water, or with a creamy mixture made by rubbing a lump of borax in a teaspoonful of water on a slate. Put in the joint a piece of silver solder the full size thereof, and clamp with tongs heated to a light red (not white) heat. As soon as the solder fuses blacken the tongs with water, and take them off. Remove the saw, hammer it if necessary, file down to an even thickness, finishing by draw-filing lengthwise.

Albert A. Pope, of Boston, Mass., sends out another circular letter in favor of better roads—highways. Such better roads, he claims, would serve as feeders to railroads, and increase their profits. His idea seems to be that every railroad should have its "road department" (common road), and in this we are by no means sure that he is not right.

He goes on to show that the building up of suburban districts is mainly dependent upon good common roads—how railroads would benefit by good highways. There is a world of argument in what he says.

The prospects of cholera to come still continue to stir up the authorities of cities as to the means of prevention. Cholera may not come to this country as an epidemic, but the fear of it will work out a better water supply and a better sewerage system in many a city in the country. The fear of the plague will work good results. Besides this there is a likelihood that many nuisances in the vicinity of New York will be abated by process of law.

The New York & East River Ferry Company was recently incorporated, at Albany, with a capital of $750,000, to establish a ferry route to and from one or more places in New York City on East River, and one or more points located in Long Island on East River. Directors—Richard V. Clark, George Hyatt, R. Emmett Doherty, George H. Conklin and Edison Nellis.

It seems to be the decision of the courts that Edison is the inventor of the base patents on incandescent electric lighting, and that other companies must pay tribute to him if they use such lamps. As there was more than 10,000 pages of printed matter involved, we shall not attempt to digest it.

"Hope for the people" is what the *Evening Journal*, of Jersey City, heads an article with in a recent issue. It is all about the probability of the overthrow of the coal combine, which the *Journal* has worked faithfully and persistently for.

MANUFACTURES

The Colburn Electric Manufacturing Co., Fitchburg, Mass., has issued a very neat circular of electric motors, dynamos, etc.

The Berlin Bridge Co., of East Berlin, Conn., has secured a contract for the erection of a new iron bridge at Norwich, Conn., to cost $19,000.

E. F. Keating, 75 John street, New York, is handling the pipe wrench illustrated in our issue of September 22, made by the Roll Paper Cutter Co., Groton, N. Y.

The Excelsior Machine and Cleveland Punch and Shear Works Co., Cleveland, O., send us a catalogue illustrating a large line of punches, shears, and other metal-working machines. The catalogue is a fine one, very fully illustrated.

A certificate of the incorporation of the Phelps & Dingle Manufacturing Company was filed at the New Jersey County Clerk's office recently. The incorporators are: Lucius J. Phelps, Samuel R. Dingle and Ida May Phelps. The company will engage in the sale of bicycles at Passaic City.

A charter was granted recently to the W. J. McCahan Sugar Refining Company, of Philadelphia, with a capital of $2,000,000, divided into 20,000 shares. The company is organized for the refining and manufacture of sugar, and the purchase of raw material for that purpose.

Several new additions are to be made to the plant of the Carondelet Electric Light and Power Company, of St. Louis, Mo. Two more dynamos have already been ordered, and the building is to be considerably improved to meet the increase of the company's business. The new office of the company is now being fitted up on the second floor.

There is water-works agitation at Corpus Christi, Tex; Ludlow, Ky.; Vancouver, B. C.; Greenville, Me.; Port Townsend, Wash.; Yarmouth, N. S.; Houston, Tex.; Evanston, Ind; Elkhart, Ind.; Buckley, Wash.; Woodland, Cal.; North Brookfield, Mass.; North Attleboro, Mass.; Elma, Wash.; Ashland, O.; Muskegon, Mich.; Spokane, Wash.; Oakdale, Ore.; Seattle, Wash.

Charles J. Darrance, Wallace B. Gilbert and John H. Parker, of Chicago, Ill., have incorporated the Composing Machine Company, with $5,000,000 capital, for the manufacture of type-setting machines. The machine is made like a typewriter, the letters, which are of steel, making direct impressions in the papier mache matrix, from which plates may be made direct. A proof-sheet of the matter set is printed as rapidly as the words are cut in the matrix.

George B. Grant, Lexington, Mass., writes us, in reference to his book on gearing: Perhaps the item of new edition and reduction in price from one dollar and a half to one dollar for cloth, and to sixty cents for paper cover, is worth a place in your column of notices. The first edition went off so fast that another is now under way. The book is in use as a reference book and text-book by the mechanical departments of Cornell, Ann Arbor, Rose Polytechnic, and other institutions, not to mention many drafting schools.

Among the latest additions to the list of St. Louis manufacturers, we notice the name of the Strawbridge Lampel Manufacturing Company. The officers are: D. Strawbridge, president; William Lampel, vice president, and F. L. Lampel, secretary and treasurer. They will manufacture light machinery, models, dies, metal molds, wood and metal patterns, etc. Their specialties will be gear cutting wire forms, band sawing, drafting, punching, wood turning, perfecting inventions, brass and iron castings, repairing of machinery, etc. The works of the company are at 412-414 South Sixth street, St. Louis, Mo.

The McMahon Belting Company, recently incorporated under the laws of Missouri, with a capital stock of $25 000, represents a reorganization to carry on an established business, hitherto conducted by George P. McMahon & Co., manufacturers of the well-known Crown brand of rawhide lace leather, under patents covering the process granted to Mr. George P. McMahon. The new company acquired these patents the business, plant, etc., and have added largely to the former facilities for manufacture, the several departments of the factory now occupying the two buildings at 116 and 118 South Commercial street, St. Louis, Mo. A visit to the factory disclosed that a very effective mechanical process of softening the hide is employed; that the product is made uniform in thickness by an original and practical method, without the use of a splitting machine, thus insuring the natural strength of the leather; and that an improved method of stretching the leather, so that the objectionable feature of having the belt ends part from stretch of lace, shortly after lacing, is obviated. We may add, that a broad claim of advantage made on behalf of this process of lace leather manufacture is, that it is free from any and all chemical compounds tending to impair the quality of the product. The officers of the corporation, who are well-known St. Louis business men, are William Baggot, president; G. G. Weare, vice-president; Patrick Baggot, secretary and treasurer, and G. P. McMahon, manager.

Machinists' Supplies and Iron.

NEW YORK, October 29, 1892.

Iron—American Pig—We quote Standard Northern brands. No. 1 Foundry, $15 to $15.50; No. 2, $14 to $14 50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $13.50 to $14 for No. 2; and $12.25 to $13 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is firm. We quote L. X., 11¼c. to 11½c.; Cookson's, 11⅝c. to 11¾c.; Hallett's, 10¾c. to 10¾c.

Copper—The high price of Lake Copper seems to prevent business transactions. Companies continue to quote 12c. It is believed that a bid of 11 65c. may influence a sale. Casting Copper is held at 10⅜c. to 10¾c.

Lead—The market is somewhat easier. Future delivery is offered freely at 3.90c. to 3.95c., while spot supplies are held at 4c., with no business to report.

Lard Oil—Prime City is quoted at 70c. to 72c.; Western on spot at 69c.

Spelter—The market continues quiet and nominal at 4.40c. by the car load for New York delivery.

Tin—There is no particular change in the market; it has ruled easy, with business at a slight concession from previous rates. Sales have been made at 20.60c. to 20.80c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Draftsman exp'd in eng. boilers and gen. mach. wants steady position. O. K., AM. MACHINIST.

Wanted—Good mechanical draftsman; state exp. and wages expected. Kenney & Co., Scottdale, Pa.

Mechanical and architectural draftsman, 27 years old, wants position. Address Box 24, AM. MACH.

Wanted—Agents to sell calipers, etc.; liberal inducements. E. G. Smith, Columbia, Pa.

Wanted—Three first-class lathe men at once. Gisholt Machine Co., Madison, Wis.

First-class mechanical draftsmen wanted. Address BOX 27, AMERICAN MACHINIST.

Wanted—Position as draftsman, by young man with tech. education; 3 years as machinist, and 2 years as draftsman; age, 24 years. Box 28 AM. MACH.

Foundry foreman, of 20 years' experience on locomotive, pump, and general machine castings, is open for engagement. G, office AM. MACHINIST.

Wanted—A position as draftsman and designer; practical exp. in best shops in country; gearing thoroughly understood. X X, care AM MACHINIST.

Young machinist, of good general experience and ability, desires position as department or assistant foreman; first class refs. Box 29, AM. MACH.

Position wanted by mech. eng. and draftsman. Heavy and light work, mining mach. Thor. tech. education, good math'n. Box 403, Scottdale, Pa.

Wanted—Mech'l draftsman, who understands construction of narrow goods looms, and textile mach'y. Address, stating exp., Looms, AM. MACH.

Mechanical engineer seeks a position in New York; four years' experience, and first-class references; good draftsman. Graduate, care AM. MACH.

Wanted—Three planer hands, 3 lathe hands, and 2 floor hands, all first-class men. Sioux City Engine Works, Sioux City, Iowa.

Wanted—Foreman for small foundry making machinery castings; one who can make it pay; give refs., and state salary expected. Box 26. AM. MACH.

Mechanical draftsman, first class, good designer, European technical graduate, wants position. Address R, Box 29, AMERICAN MACHINIST.

Machine draftsman, of drawing room experience, wants engagement where neat and accurate drawings are required. Box 25, AMERICAN MACHINIST.

Wanted—An experienced draftsman, accustomed to engine and saw-mill machinery. Address Box 465 Vancouver, B. C., Canada.

Competent mechanical draftsman, with shop experience, speaking French and German, desires position. Address E. L., 301 E. 114th St., N. Y.

A mechanical engineer, experienced in design and construction, desires a situation in New York or immediate vicinity. Address A, Box 1187, N. Y.

Wanted—A layer out in a boiler shop, used to all kinds of work; state age experience, and wages expected; also a sheet iron worker. Address Box 1201, Boston, Mass.

Wanted—A first-class man to act as agent and salesman for the Corliss engine; must understand the use of the indicator, and be familiar with the engine; references required. Apply to Hewes & Phillips Iron Works, Newark, N. J.

Wanted—Foreman for boiler shop employing about 50 men; the applicant must be familar with the construction of stationary and portable boilers, tanks, etc.; state age, exp., and wages expected. Address, giving refs., Box 494, Titusville, Pa.

Position in charge with live company wanted, by thorough mechanic, experienced in developing light machinery, and patented articles, and building tools for mfg. same; similar position held for past 8 years. Address "Mass," care AM. MACH.

Wanted—Machine shop foreman to take charge of 30 or 40 hands in Eastern Penn. A mechanic who can insure first-class work only, and can systematize work and methods to the best advantage as to cost; must understand best jig and duplicate work system. Address Box 21, care AM. MACH.

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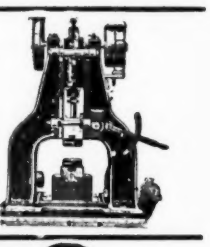

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PATENT UNIVERSAL DEPTH ANGLE AND SCREW-CUTTING CENTER
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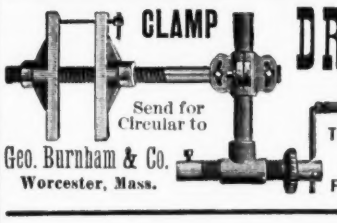

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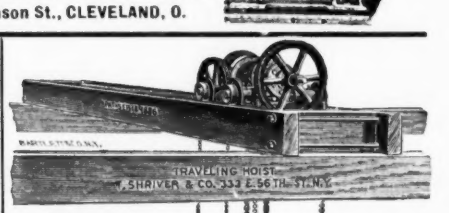

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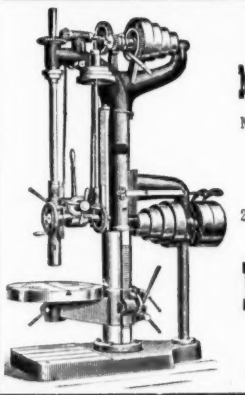

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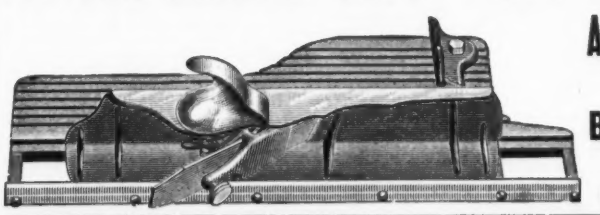

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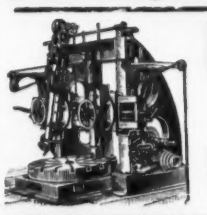

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Light, Sensitive and Rapid Drilling.
The principal feature of this drill is, the power is greatest when speed is slow and large drills are used, and most sensitive for small drills under high speed. A very valuable feature never before attained in a Sensitive Drill. By this great advantage we more than double our working power.
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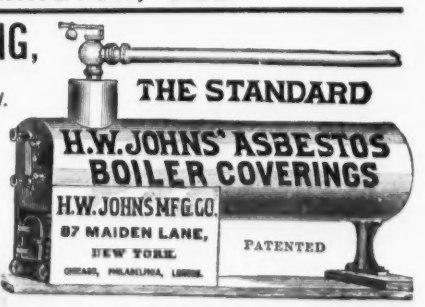

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17 in. x 8 ft.	do	do do do
16 in. x 6 & 8 ft.	do	do do do do
15 in x 6 & 8 ft.	do	do do do do
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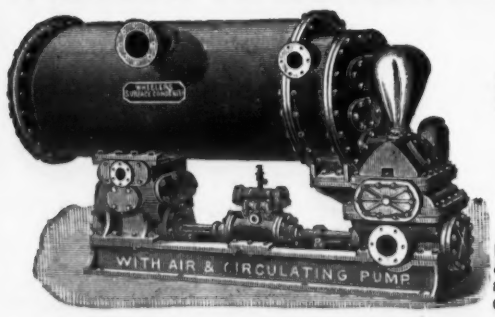

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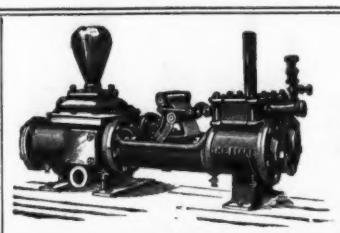

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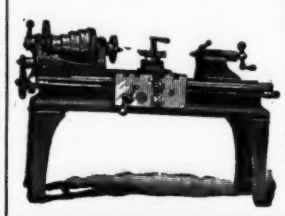

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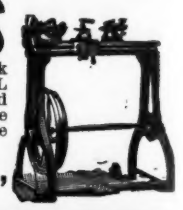

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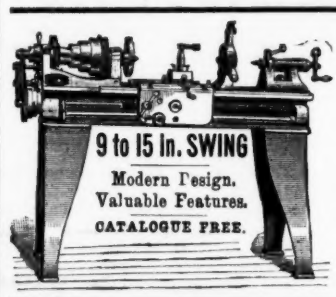

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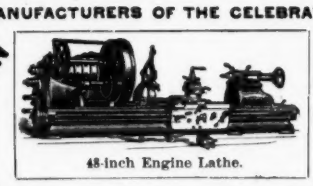

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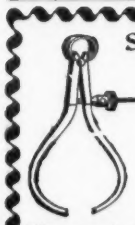

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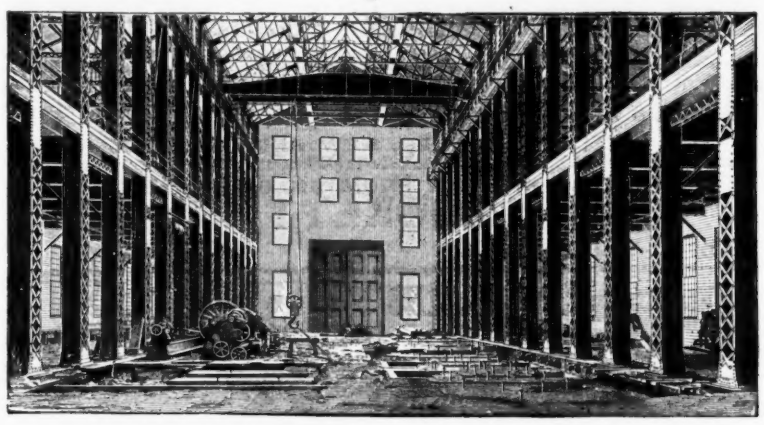

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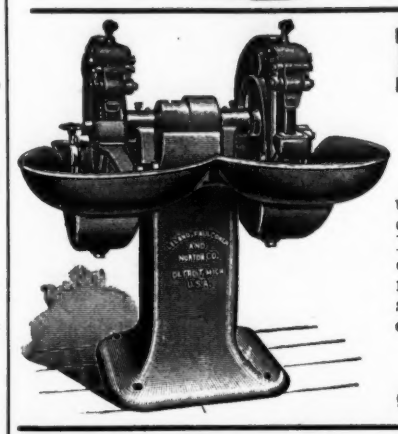

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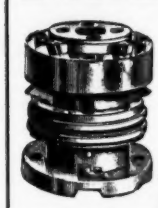

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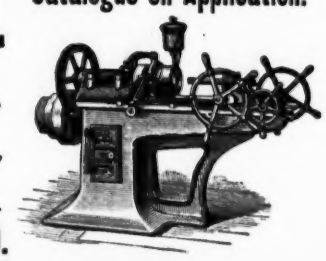

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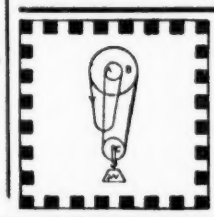

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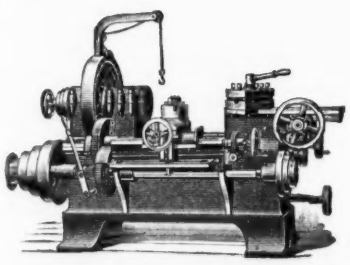

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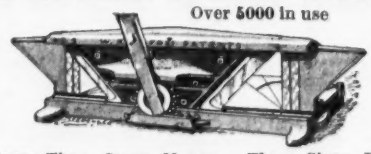

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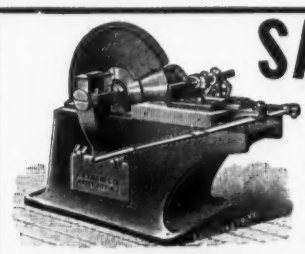

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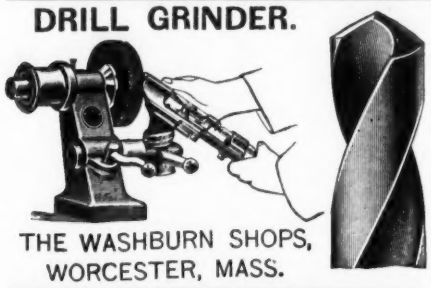

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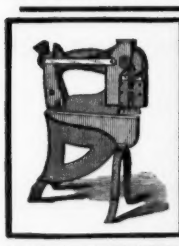

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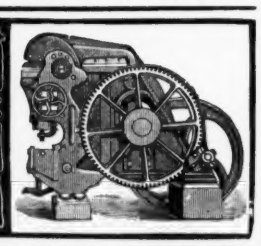

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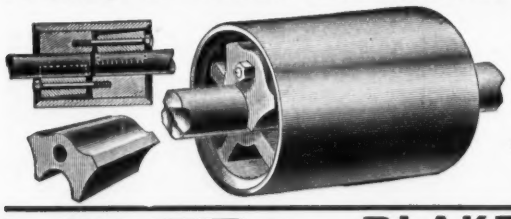

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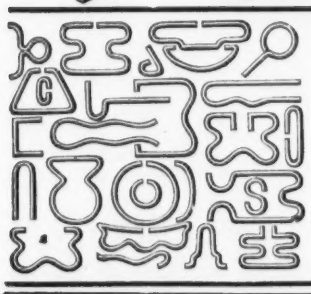

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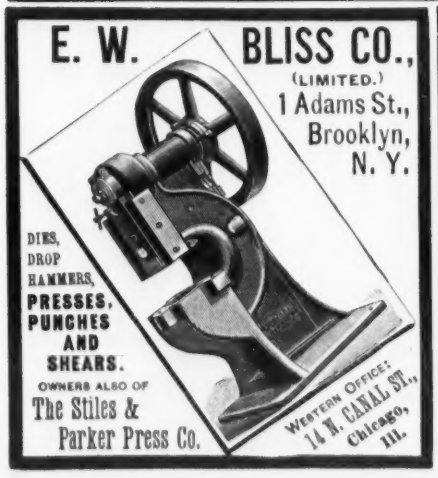

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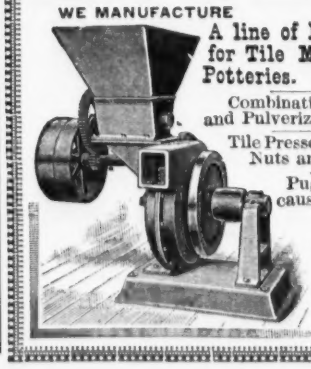

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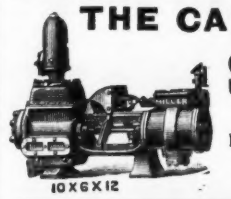

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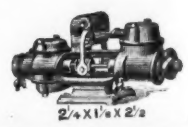

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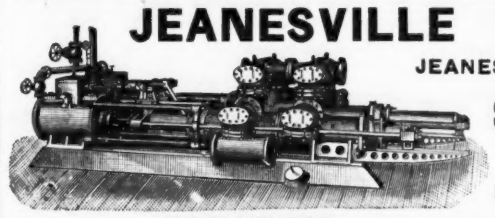

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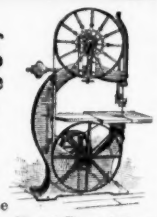

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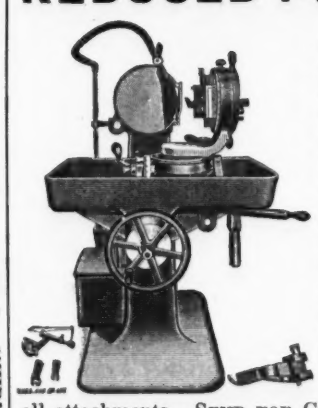

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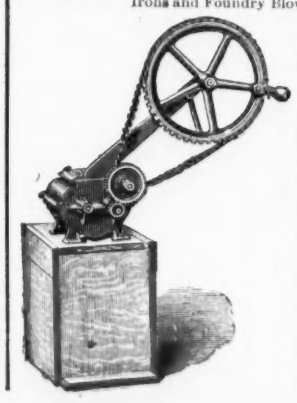

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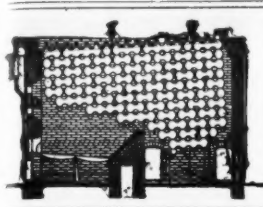

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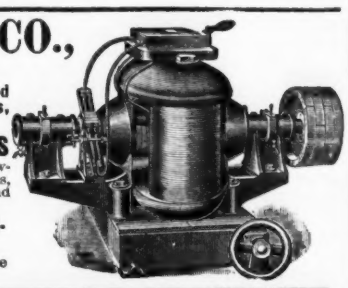

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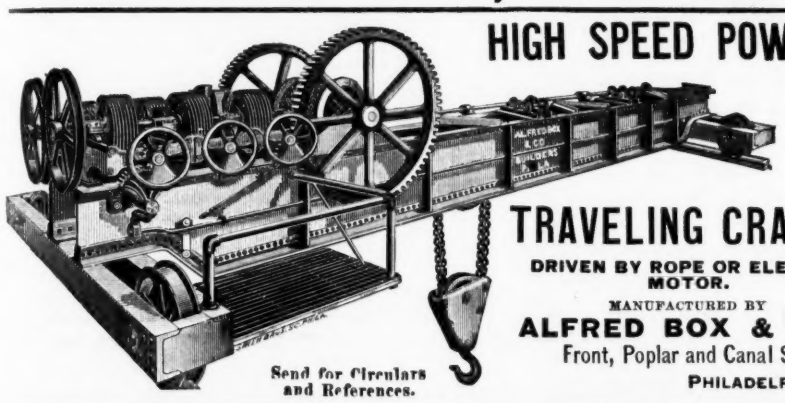

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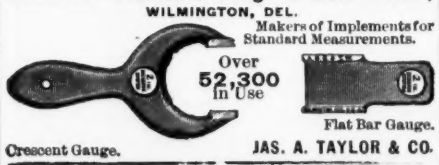

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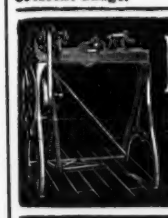

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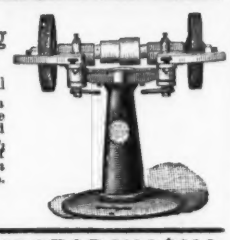

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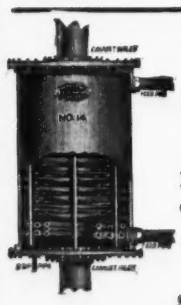

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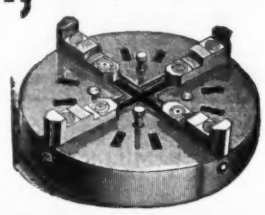

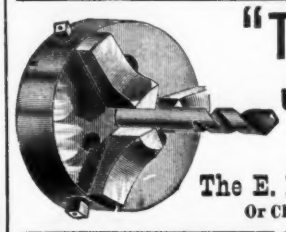

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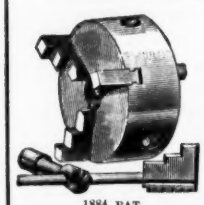

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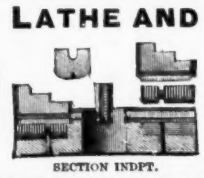

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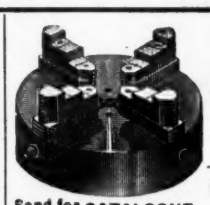

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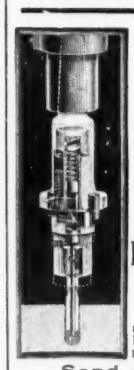

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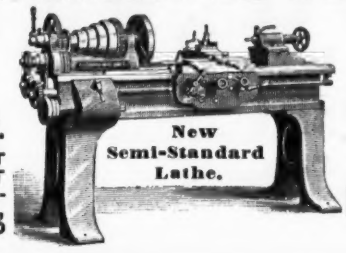

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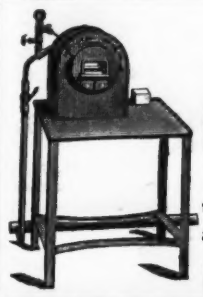

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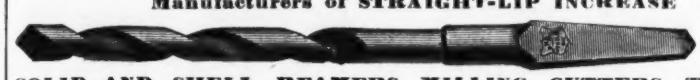

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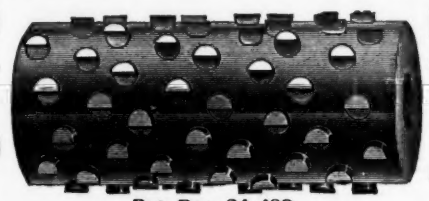

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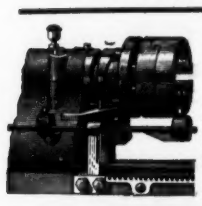

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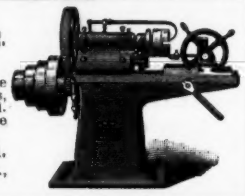

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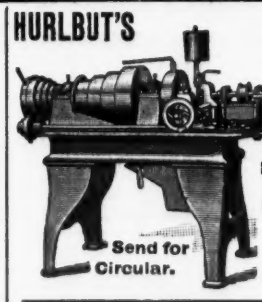

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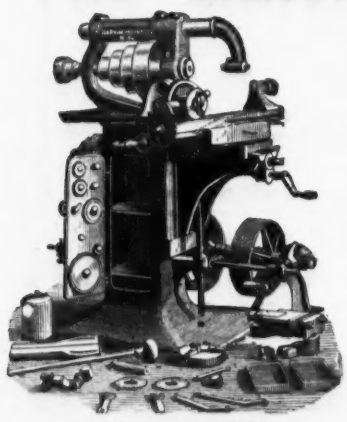

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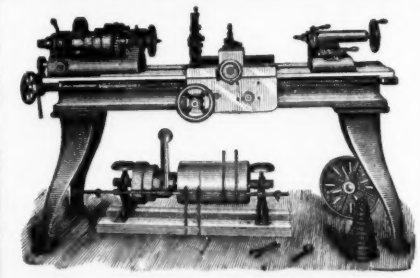

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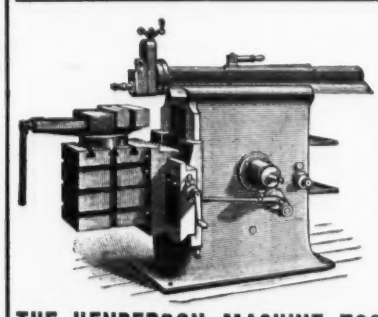

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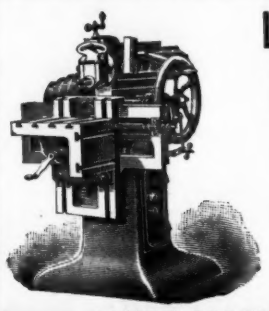

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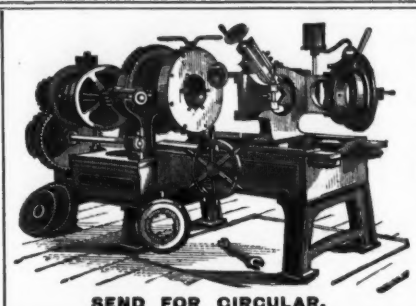

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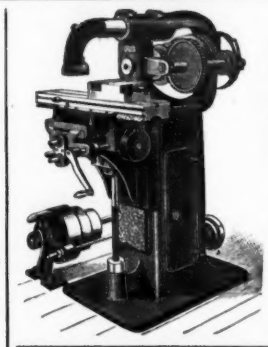

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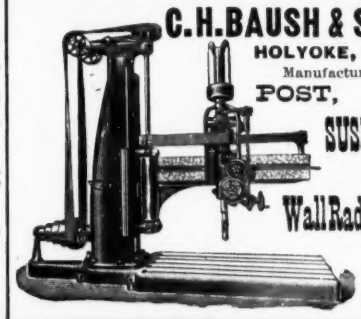

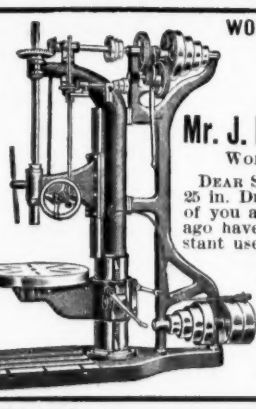

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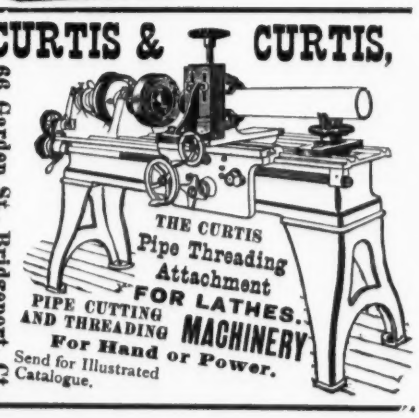

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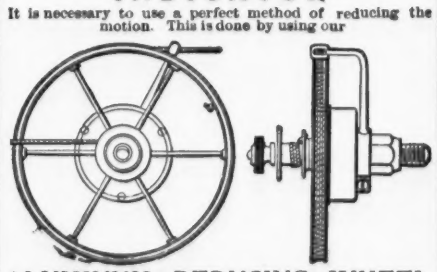

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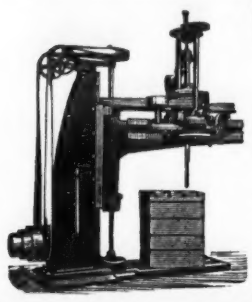

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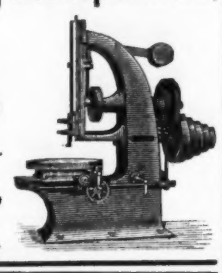

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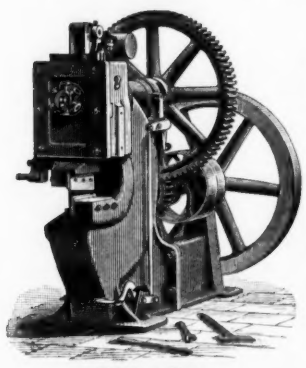

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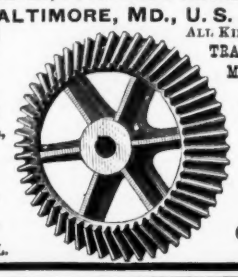

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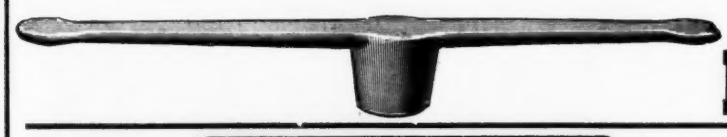

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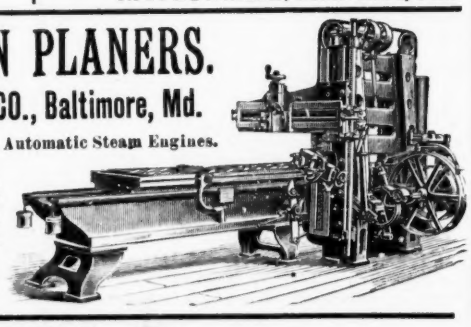

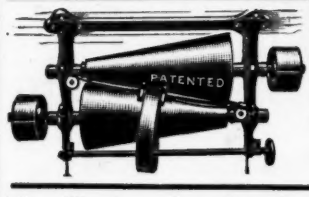

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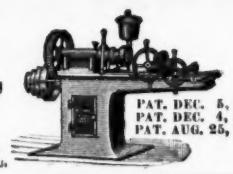

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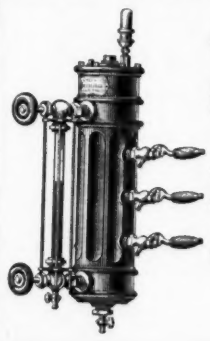

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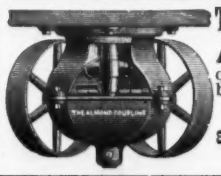

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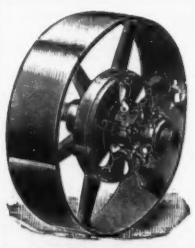

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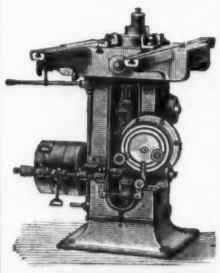

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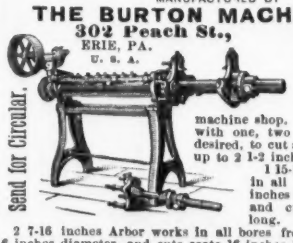

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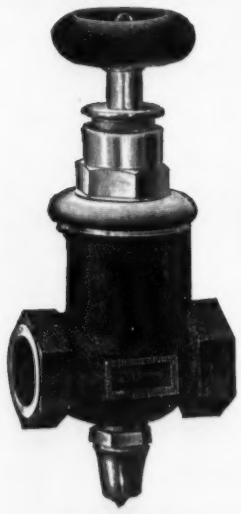

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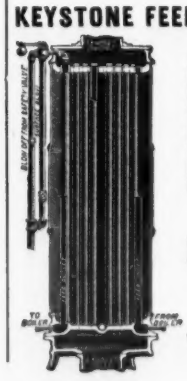

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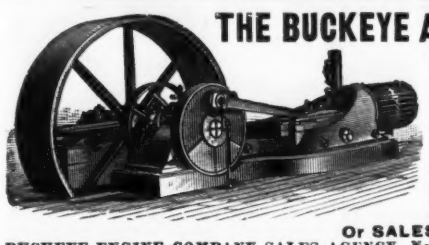

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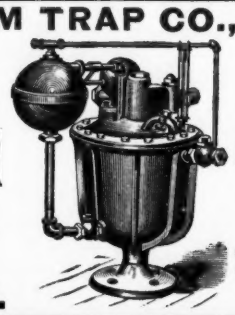

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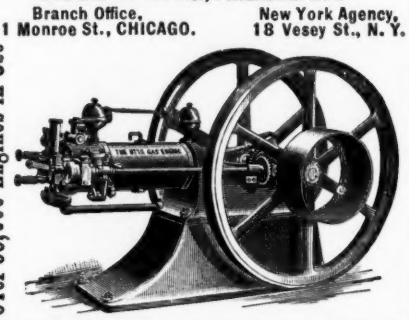

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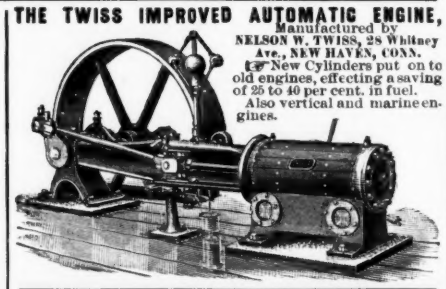

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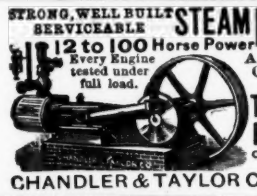

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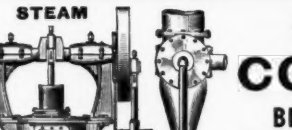

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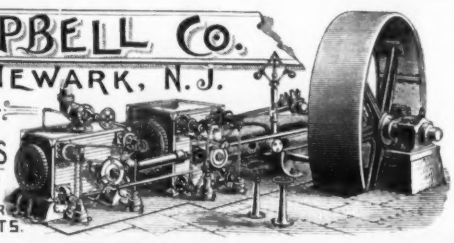

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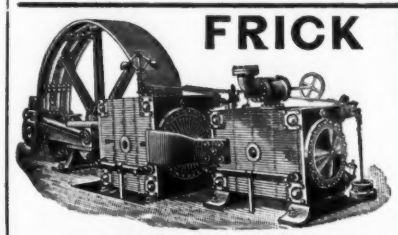

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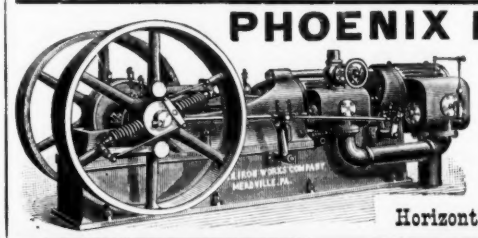

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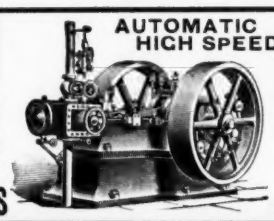

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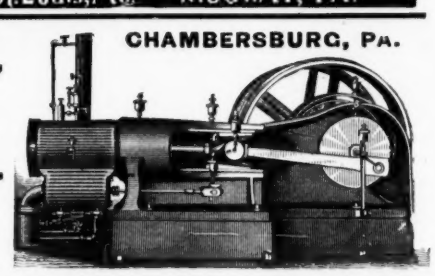

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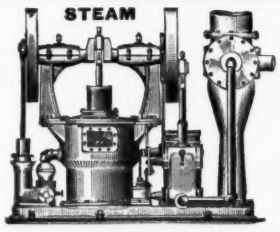

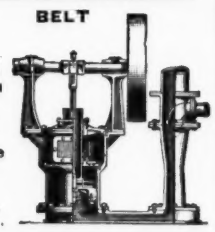

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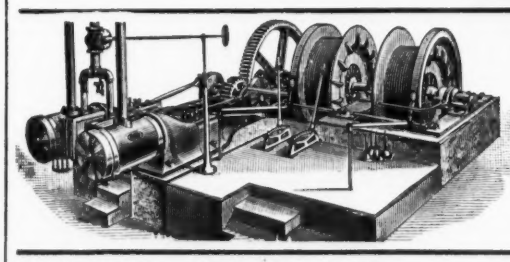

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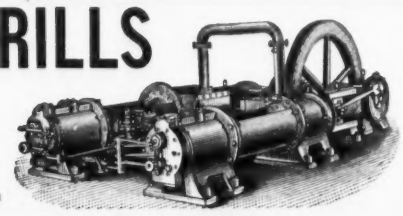

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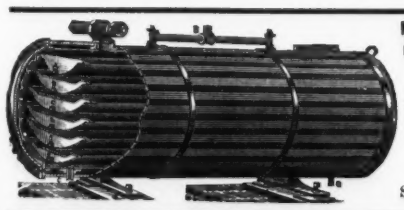

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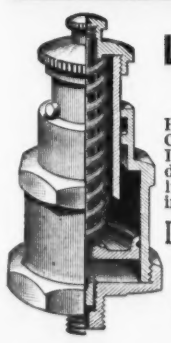

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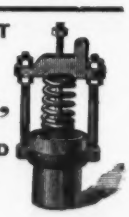

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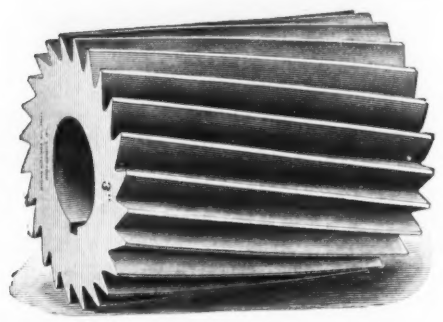

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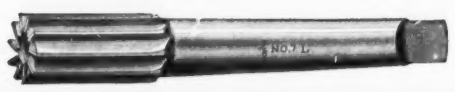

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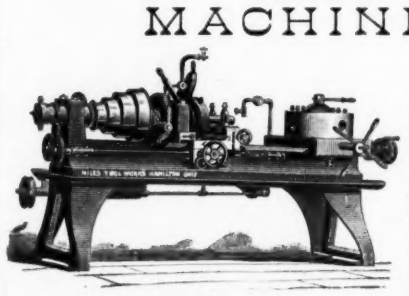

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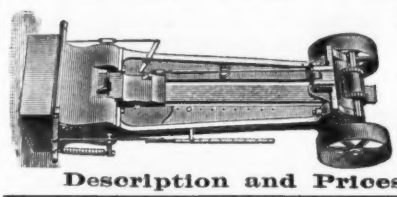

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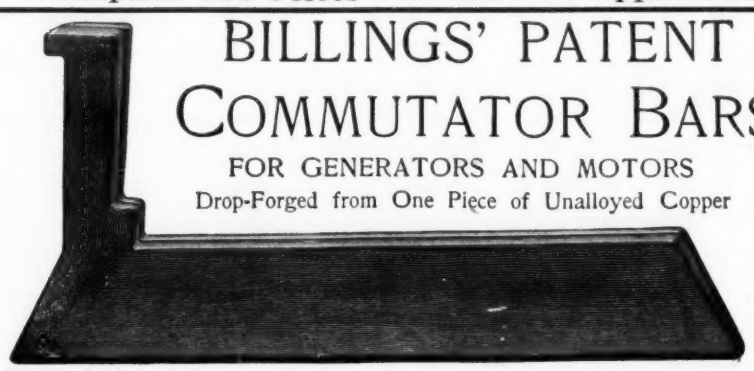

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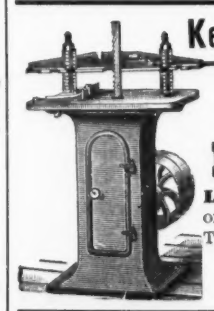

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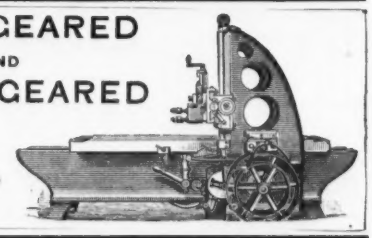

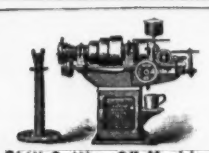

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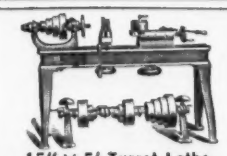

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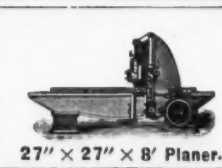

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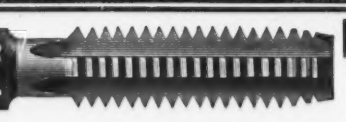

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